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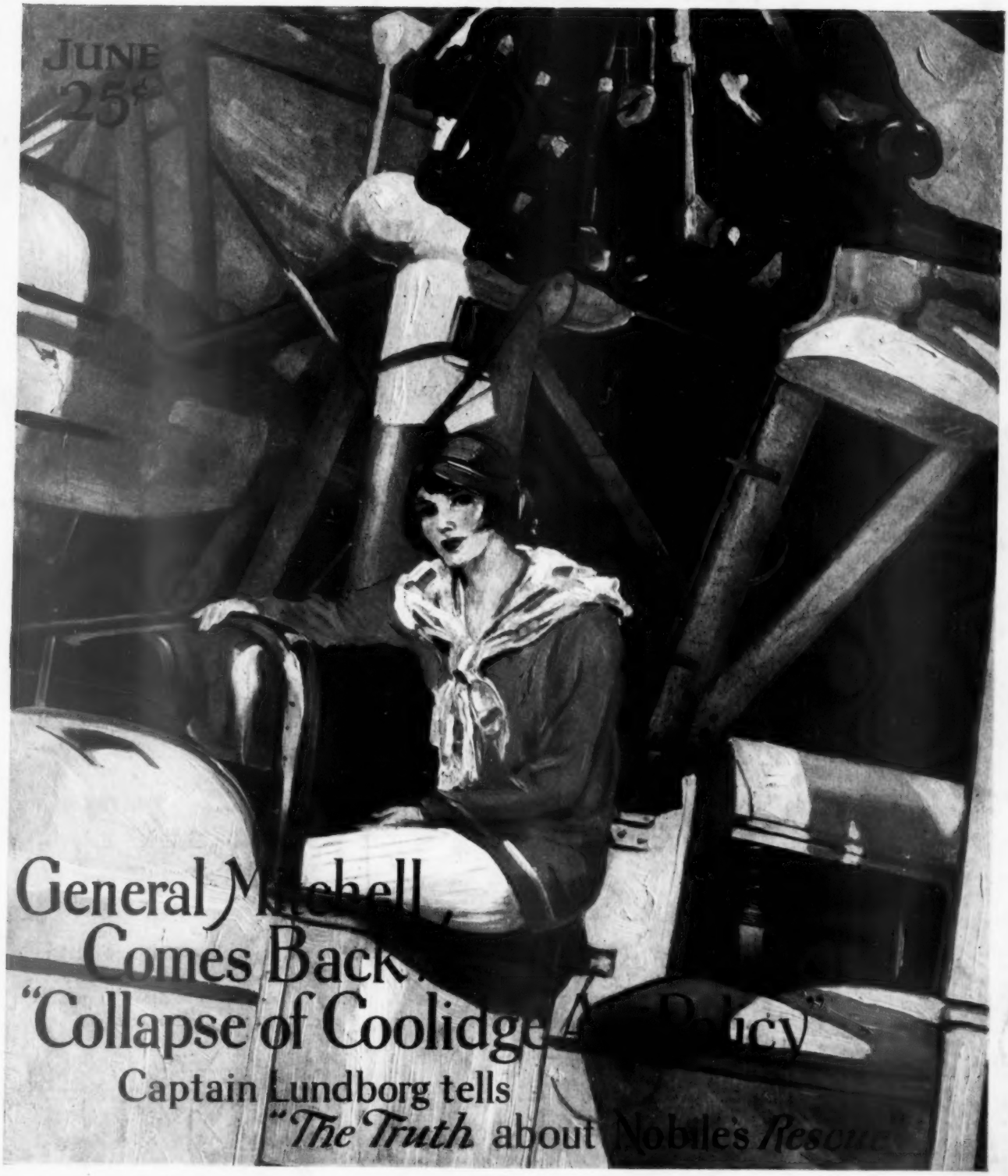
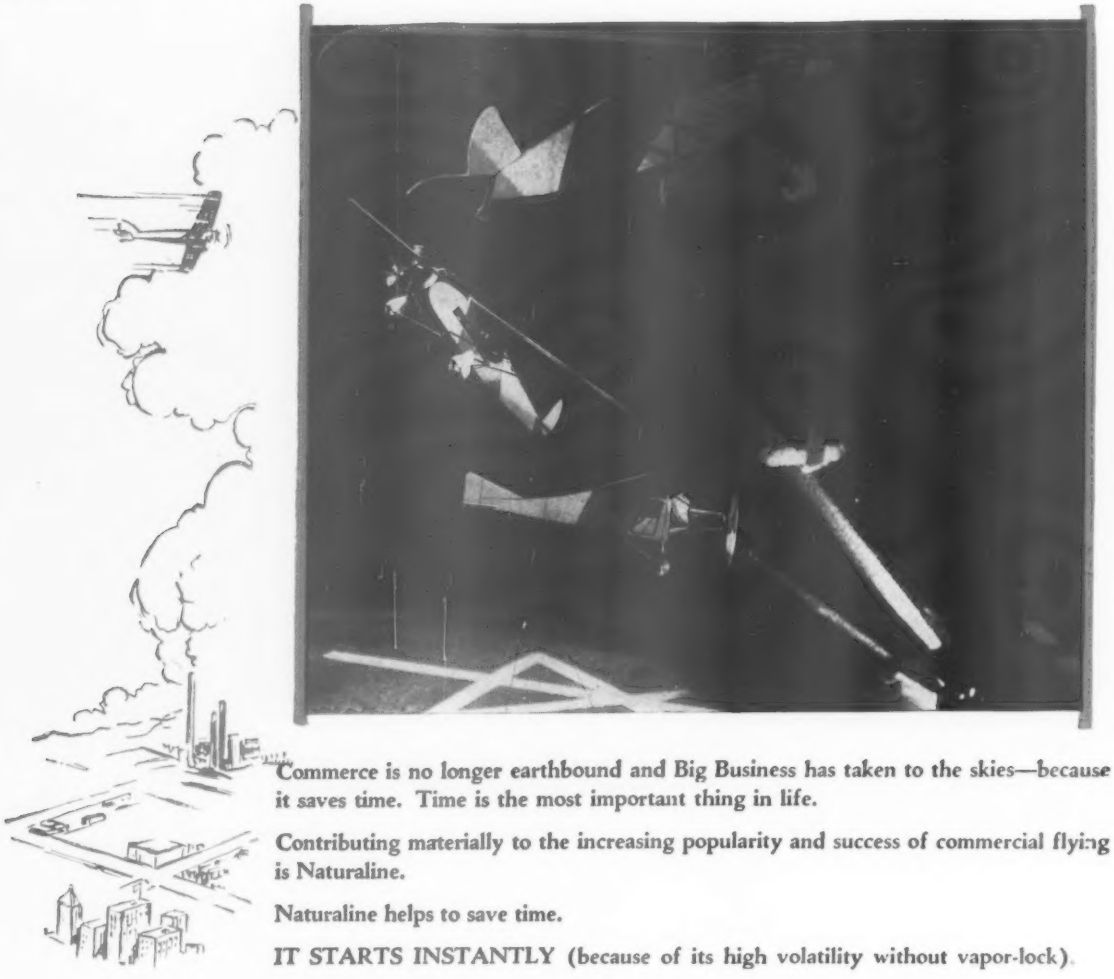
Aeronautics

formerly **POPULAR AVIATION**



Largest Selling Aeronautical Publication in the World

Time Flies with Naturaline



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Contributing materially to the increasing popularity and success of commercial flying is Naturaline.

Naturaline helps to save time.

IT STARTS INSTANTLY (because of its high volatility without vapor-lock).

IT INCREASES THE SPEED (because it increases the r. p. m., 50 to 125 depending upon the type of motor).

IT LENGTHENS THE FLIGHT (because it means a fuel saving of from 5-15%).

IT TAKES MORE ABOARD (because it is 46 lbs. per 100 gals. lighter).

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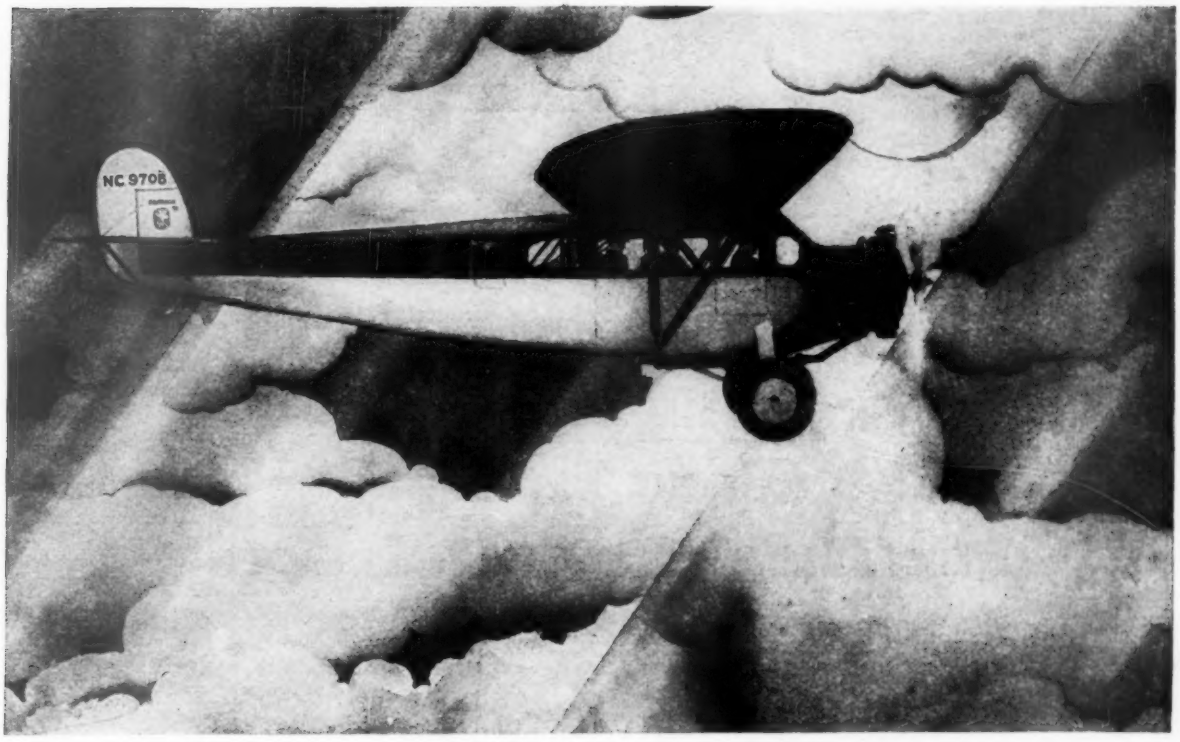

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The "71" has a larger passenger and cargo capacity than any other single-engined ship of equal speed. At $18,900 flyaway Farmingdale, it has a demonstrated yield per dollar of investment which is definitely *higher* than any other ship now offered to the public. Write or wire Fairchild Airplane Manufacturing Corporation, Farmingdale, L. I., New York.

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THE FAIRCHILD "71" *seven-place cabin monoplane for transport, mail, and commercial uses. A larger passenger and cargo capacity (145 cu. ft.) than any other "Wasp" engined plane of its speed. Folding wings. Floats or skis installed in a few hours. Fine interior finish. Soundproofing. Heater. Disposable load 2500 lbs. High speed 138 m.p.h. Cruising range 750 miles at 110 m.p.h.*

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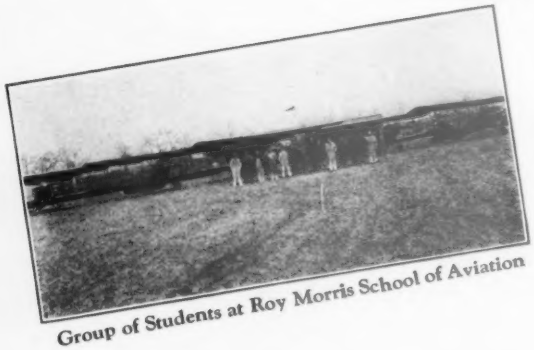
Roy F. Morris, Manager

Topeka, Kansas



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Specifications of Lincoln PT

Type	Tandem Open Cockpit Biplane
Length over all	23 feet 7½ inches
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Wing span, upper	32 feet 3 inches
Wing span, lower	31 feet 9 inches
Chord both wings	58 inches
Wing area including ailerons, upper	153½ sq. ft.
Wing area including ailerons, lower	144 sq. ft.
Ailerons area	30½ sq. ft.
Rudder area	8½ sq. ft.
Fin area	3.2 sq. ft.
Stabilizer area (adjustable from cockpit)	22.4 sq. ft.
Elevator area	20.6 sq. ft.
Split type landing gear—Nickel steel axles—McWythe Streamline wires	
Weight empty (with OX5 engine)	1270 pounds
Useful load	395 pounds
Gross weight loaded with OX5 engine	1800 pounds
Power plant	OX5 or any engine from 80 to 110 H.P.
Performance	High speed 105 M.P.H.
Landing speed	Under 30 M.P.H.
Cruising speed	95 M.P.H.
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Absolute ceiling	15,000 feet
Cruising range	300 miles
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12 major factories are now manufacturing airplanes and aircraft motors here. Highest type, experienced, skilled labor is available; 20% of all licensed pilots; 20% of all identified aircraft; 25% of all aviation schools in the United States are in Southern California.

There are 50 or more airports and landing fields in Los Angeles County alone. (See graphic map at left).

Climatic and other conditions are bound to make this the aviation capital of America. The advantages of this immediate territory are not to be had elsewhere.

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Freedom from Labor Trouble
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Cheap and Abundant Power and Water
Cheap Fuel
Low Building Costs
Largest Western Market
Splendid Export, Rail and Highway Outlets

Above map shows part of Los Angeles County. Every dot represents an airport or landing field.

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Winged transport ships fly the air lanes of today with the regularity of ocean liners. Truly aviation is a business!

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For aviation is a business. We know it. You know it. And the public is grasping it fast. For men will take their ways upon the air as now they take a taxi . . . men will sleep among the clouds as tonight they ride the Pullmans. And people who are asking themselves about a two-car garage will sometime worry about a hangar.

This is a business. Our common interest is to develop it systematically and in a business-like manner.

• • •

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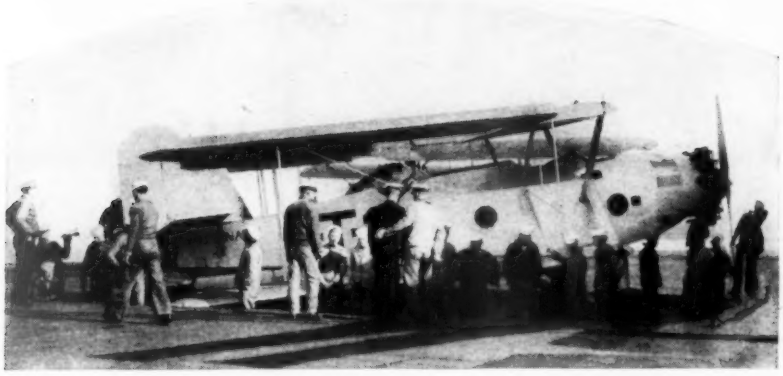

AERONAUTICS

FORMERLY

POPULAR AVIATION

June, 1929 608 South Dearborn Street, Chicago Vol. 4, No. 6

CONTENTS

The Collapse of the Coolidge Air Policy 11
By General William Mitchell.
The Truth About Nobile's Rescue 16
By Captain Einar Lundborg.
Aviation Has a Place for College Men 19
By R. N. Miller.
Where Does Weather Come From? 21
By M. Luckiesh.
Pilot Trouble vs. Engine Trouble 24
By Lieutenant Benson Hoy.
Air Raids on Mosquitoes 26
By S. R. Winters.
Modern Valkyries 28
By John Goldstrom.
Business Says "You Must Fly" 30
By John C. Nulsen.
Large Scale Operations 34
By Archibald Black and G. F. Wheeler.
Monthly Financial Review 42
By J. Allen Grover.
Current Comment 48
By the Editor.
Popular Aerial Photography 50
By A. H. Beardsley.
Simple Aerodynamics 58
By Alexander Klemin.
Naval Influence on Aircraft Design 64
By Andrew R. Boone.
Washington and Aeronautics 73
By Fred DeWitt Shelton.
The Morris Hydro Model 91
By Bertram Pond.
Directory 105
Index of Advertisers 114

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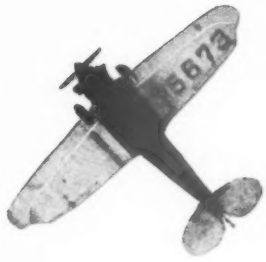
Man! What an airplane!



A *MAN'S* ship, gentlemen, built for he-man usage!

Do you want *speed?* You can shove the air-speed indicator up to 140 and over, and hold it there as long as you care to. With 220 horse power, you can really get somewhere in *this* ship. The Transcontinental Air Derby last year proved that!

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"I Told You So"

IF ANY MAN is entitled to say "I told you so," it is General William Mitchell. Our history can point out no clearer case of a man sacrificing his career for an ideal—for the ultimate good of his country.

Probably no one man in the history of aviation has so definitely proved his foresight and his sincerity. Certainly no man tossed away his professional life with such a gesture.

Years ago his straight and forward looking mind, combined with the stark practicality of war experience, gave him more than a mere vision of what was to come in aviation.

It is not necessary to make any apologies for him. His one fault lay in the fact that he made no concession to existing practices that he knew to be wrong. He cut through the maze of precedental tactics and set forth all too clearly what was to be.

He marshalled facts and with irrefutable logic showed that control of the air meant control of both sea and land.

In asking for a separate air force he made his great mistake—although he asked no more than had been found advisable and necessary in the conduct of the war by Great Britain, and other powers. He definitely antagonized official Washington; and did more—he threatened the smug complacence of bureaucratic office holders.

Mind you, at this time there had been no actual tactical demonstration of the facts which he held to be incontrovertible. Since that time London has been tactically attacked in a war game, likewise the Panama Canal, and during May our own Army is to put on a "show."

Have the inescapable conclusions of these sham wars been placed before the public? Have the real facts as to the outcome of these attacks, which are prophetic of the next war, been released by the officials? They have not, and probably will never be made completely accessible to inquiry. They show that General Mitchell was right, and that the keen logic of his war-trained mind was never at fault.

More articles by the General will follow in future issues of AERONAUTICS, which continues its policy of giving its readers the best on aeronautical subjects, by writers of unquestioned prominence and ability.

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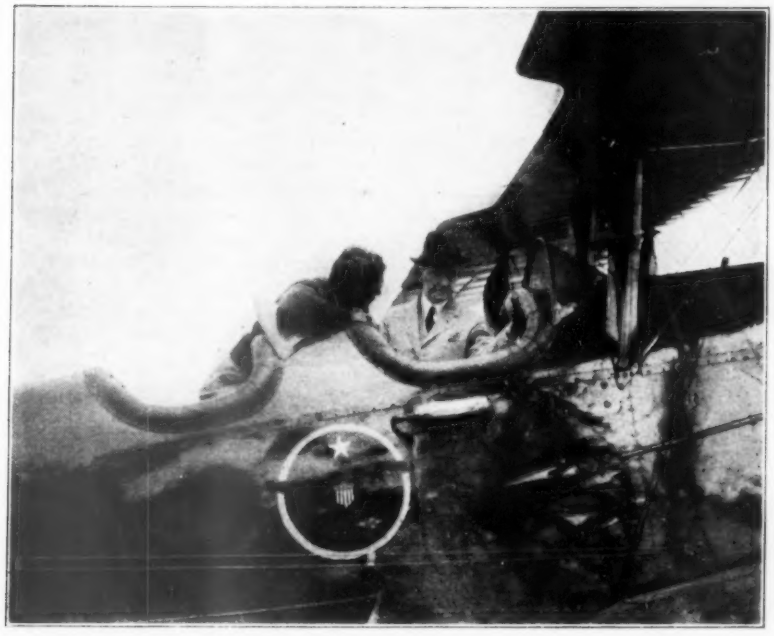
The Collapse of the Coolidge Air Policy

By General William Mitchell

Former Commander Air Forces, A. E. F., and Director, Military Aeronautics, U. S. Army

General William Mitchell
Author of this series of articles dealing with our national defense.

"President Coolidge was told of the conditions that faced the development of aviation in this country."



THE world has arrived at the aeronautical era.

During this stage of our development, the destiny of nations and the future progress of civilization depends upon air power.

Most of us have a very hazy understanding of what air power is. In a general way, air power, as distinguished from land power or sea power, is the ability to do something in the air. It is able to operate and do its work anywhere over the world, because wherever there is air, aircraft can go. They are hitched neither to the land nor to the sea, but are able to fly across the North or South Pole, the Tropics or the Temperate Zone, over land or sea.

Transportation has been called the essence of civilization. The ability to transport persons or materials or even thoughts with great rapidity renders possible the organization and control of

larger and larger cities, states and countries.

Air power allows a quick interchange of commodities, it permits a speedy transfer of commercial paper of various kinds, and above all, it assists national defense greatly, because when a nation is menaced, its military power must be moved in the most rapid way to the threatened points. Hitherto, when transportation was confined to the land and water, railways had to be depended upon as the quickest means of going from one place to another. Railways are confined to the places that have the least gradients, or the easiest ascent up mountains. The banks of rivers and low divides or passes at their heads determine where the railways have to go.

Transportation along the ground, whether by railway or road, soon becomes congested at its narrowest points. The air is not limited in this way, as the whole earth is covered with a roadway eight miles deep. There are no passes, no mountains, no forests, no deserts in the air. It is the same all over the world.

At sea, the pathway for ships has been more or less parallel to the Equator, which is the longest way around the world. Ships are not able to go very far north or south on account of ice, fogs and cold. Aircraft are not limited by such conditions. They are able to fly over the shortest routes, whether these be across the temperate zone or the tropics, or the North or South Pole. In fact, the colder the weather, the better it is for flying in many ways, because the air is heavier, which allows the propellers of the airplanes to take hold of it better and prevents moisture being taken up in the air, causing fogs and storms. The colder the air, the less moisture it can hold.

At the present time, there is no limit to where aircraft may go over the earth's surface. The only limit is the height they can attain. It is believed that the air over the earth which is capable of sustaining aircraft with their present means of propulsion extends up to a height of something around 55,000 feet. Airplanes are constantly attaining new heights, and, as we ascend, the resistance to our progress through the atmosphere grows less. Possibly in the future we shall be able to go beyond our atmosphere and actually enter space.

It may be said that these things are all very well in theory, but what are aircraft actually able to do? In other words, what goods can they deliver now? In estimating this, not only must we take into account what has gone before but also what we are certain can be done with the means we have at hand at present. All of us who have developed aviation from the beginning have had to overcome the prejudices, dislikes and conservatism of the older systems, both military and civil, that have always attempted to minimize the ability of air power.

We may definitely say now that we can construct aircraft that are able to fly with certainty from America to Europe and back, from America to Asia and back without landing, across the Pacific and across the Atlantic, from America to Africa, America to Australia, either straight across the oceans or by way of the sea islands or the Antarctic continent. We can make instruments that without the touch of human hands will take airplanes straight through storms, rains, snow and hail, that will allow them to take off and fly in fogs, to land in fogs, to find their position with unerring accuracy over any part of the world. They are able while in flight to communicate with the speed of light by radio telegraphy anywhere they desire. They may refuel while in flight. They are able even to change engines in the air or to repair propellers. One aircraft is able to land on another one, or be launched from another. We are able to send aircraft on their voyages with an automatic pilot, guided by radio, and check and change their direction of flight. We may easily obtain speeds of 300 miles an hour. Aircraft, in the form of dirigible airships, can be constructed that are able to go clear around the world on one charge of fuel. The average layman has no conception of what is taking place in the world's aeronautical development.

The race among the great industrial nations now is for aeronautical supremacy. They well know that the power of the air in a military way is superior to that of an army or a navy. No ship can live on the surface of the water in the face of aircraft. Airplanes with their bombs, water torpedoes, automatic air torpedoes, gliding bombs, mines and gas can absolutely destroy any ship that ever has been built or that can be built. We proved this definitely in 1921 when we sank ships of all kinds, including one of the stoutest battleships ever made. In a future war, a nation deficient in air power will not be able to protect any of its shipping. Submarines will be the only seacraft that will be able to ply the seas.

An airplane bomb hitting a battleship. This shot tore a hole in the ship's bottom 48 feet long and 28 feet wide, and the ship sank in 20 seconds.

In land warfare, where the essence of strategy means the control or neutralization of the great cities, manufacturing centers and means of communication, one or two modern aircraft with their huge projectiles loaded with gas will be able to cause whole cities to be abandoned with a minimum of effort. Three or four 4-ton phosgene or mustard gas bombs from airplanes launched a hundred miles from New York and hitting on Manhattan Island will cause absolute and immediate evacuation of the city. The same would apply similarly to Philadelphia, Baltimore, Buffalo, Detroit and Chicago. This would mean an end to any war we might have with another power. Armies are perfectly powerless to stop it. There is no effective defense against aircraft from the ground.

Thus, in a military way, we find that air power is the point of the spear of national defense. An army has become merely a means of holding ground and occupying that which has been conquered

by air power. A navy, as the determining element in sea warfare, has lost its occupation. It is rapidly becoming an auxiliary of air power, as the submarines will be directed by aircraft as to where to go, and will be used as a means of supply, such as oil tankers, ammunition ships, carriers of spare parts and mechanics. If operations are carried through the north, submarines will be able to go under the ice to places where holes have been dug in it and there deliver their fuel and supplies to the air forces.

Naturally, we have not been able to try all these things actually in war, because air forces were used for the first time in history during the last war. What we learned in that war and what we have done since in actual operations in the snow and ice of the north, over the seas and from island to island, make us positive these things can be done.

Each nation is now organized to meet these conditions with the exception of the United States. Here we still follow the obsolete systems of a former generation. We still tie our air power to an army and a navy, instead of organizing it into a separate department, untrammeled by tradition, jealousy and pork barrel politics.

Those of us who handled the air forces in the European War recommended at once when we returned that America adopt a sensible scheme for its aeronautical future. With the wonderful men we had ten years ago and the impetus given us by the war, we rapidly became the leading aeronautical nation of the world. We had every air record. We had proved that battleships could be sunk with airplanes, we flew to Alaska and the Arctic, we flew around the world. We were building aircraft capable of carrying fifty people from New York to San Francisco in sixteen hours. Gradually, through the influence of the Navy principally, this development was retarded. They didn't stop it altogether because of the development of aviation all over the world. If anybody gets in the way of it, he will be squashed eventually.

But the army and navy decided to take it over and handle it—the Navy knowing that it would be almost displaced by air power in this country if it continued to develop. They gained control of it by obtaining the biggest appropriations from Congress, which they were able to do on account of their well-organized lobbies in Washington.

When it became apparent that this was taking place in American aviation, a great many of our distinguished air officers resigned or left the service. I tried to help it as long as I could, until the disgraceful performance of the Shenandoah airship, which was sent by the Navy to the middle states at the height of the storm season, for advertising purposes, over the protests of its commander; and the sending by the Navy of some good-for-nothing flying boats from San Francisco to the Hawaiian Islands, in which the aircraft participating did not even carry enough gasoline to reach their objective. The Shenandoah was lost and with it about two-thirds of its excellent crew. Of the three flying boats that were to make the Hawaii flight, one never started, one fell at sea a couple of hundred miles out and the third had a forced landing near the Hawaiian Islands and the whole Navy could not find it. It found the Navy after a while and was saved.

Seeing the utter futility of being connected with any such performances in our national aeronautical administration, I called the attention of the people to these things in the fall of 1925. I recommended that a board of distinterested persons be convened by the President to determine how the aeronautical problem

A two-ton bomb made for the use of our Army Air Force. This projectile carried over a ton of high explosive. It can sink any battleship ever built or to be built. Bombs twice the size of this one can be made and carried by aircraft.

XUM

should be handled in this country. President Coolidge, instead of appointing a disinterested board, "stuffed the deck." He appointed on it persons who were well known to be hostile to the independent development of aviation. When we saw the names of those composing the board, we could have written the report of their findings before they took one word of evidence. This "Morrow Board," as it was called, after taking a certain amount of testimony, determined that "the next war would begin in the air and end in the mud," and they proceeded to put aviation into the mud. Instead of creating a department of aeronautics separate from the army and navy as the English, French, Germans, Italians, Russians, and Spanish have, they merely appointed an additional secretary in the Army, Navy and Commerce Departments, which entrenched the bureaucracy more firmly than ever and gave an opportunity of passing plums to friends.

In spite of the tremendous interest being manifested by the American people in aviation, and in spite of the propaganda which the administration in Washington is issuing all over the country, through controlled press agencies, the United States is floundering worse than ever in the slough of aeronautical despond. Our great coordinated experimentation and development and operation of aircraft which obtained up until 1922 has been stopped. You never hear now how aircraft costing a few thousand dollars can sink a battleship that costs almost $100,000,000. You never hear of how an airplane can fly from Europe to America in sixteen hours and from a height of 35,000 feet attack a city like New York.

Not one single through passenger commercial air service exists from New York to San Francisco or from Chicago to New Orleans, or from America to Europe or Asia. A service can very easily be established at the present time along any of these routes. For instance, an air line from New York to Peking can be installed which would make the distance in about sixty-five hours' flying time. It would go from New York by way of Lake Athabasca in Canada to Nome, Alaska, thence to Khabarovsk on the Amur River and then to Peking. The distance is less than 7,000 miles.

The people want the aircraft and there is plenty of money available for development, but there is no central head in the Government to handle and coordinate these developments, and the result is that the jealousy, quarreling, inefficiency and expense which goes on in the Army, Navy, Commerce Department, Department of Agriculture (in all about eighteen different agencies of the government handle aircraft) handicap it tremendously.

Verville Sperry Messenger airplane equipped with the automatic pilot for aerial torpedo use. The last three shots that were made under the direction of General Mitchell by Laurence Sperry with this device were directed from Mitchel Field, Long Island, against Trenton, New Jersey, a distance of 135 miles. Each shot found its mark!

The government started on a five-year program of aircraft development which is now in its fourth year. There are actually not as many airplanes in the fighting units of the air force attached to the army as there were when they started. Their types and equipment are very little better. There are actually, at the present writing, less than forty first-line pursuit airplanes in the American service. These are stationed at Selfridge Field outside Detroit. They are deficient in speed, gun power, in ceiling and in safety devices to protect their pilots in war. There are less than a dozen modern bombardment planes with the Bombardment Group at Langley Field, Va. These are small, slow, low-powered aircraft, deficient in weight carrying ability and radius of action, and in no way suited for modern war. That is all the pursuit and bombardment aviation that the United States possesses in its Air Force.

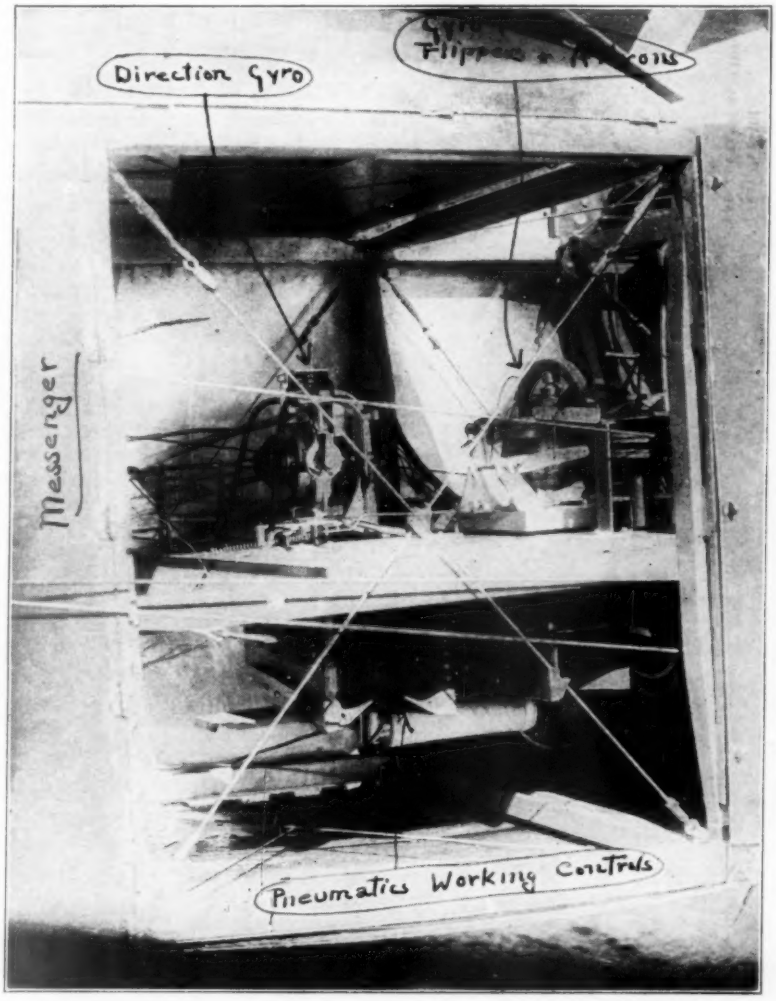
In the Navy, the delusion of the aircraft carrier and the airplane on board ship has been ballyhooed from one end of the country to the other. The actual value of these aircraft operating from vessels, in time of war, will be nil, because these ships can be sunk at once with the greatest ease by aircraft acting from land bases. It is absolutely impossible to defend them either by gunfire or by aircraft. I doubt very much whether

any aeronautical defense is possible, so great is the power of offense over defense. It is almost impossible to find aircraft flying in different directions at altitudes of 35,000 feet above the earth's surface, attack them and bring them down in sufficient time to prevent their carrying through their attack against a ship or a city. An airplane carrier with all its equipment and everything about it costs anywhere from seventy to one hundred million dollars. The dockyards, supply points and everything necessary to keep it going practically double this figure. For the price of one aircraft carrier, from one to two thousand efficient airplanes can be built, any one of which could destroy the aircraft carrier. The whole theory of the development of air power from aircraft carriers is a delusion and a myth. Every cent put into them, instead of being put into aircraft, is merely money thrown away, except to the contractors who furnish steel for building them, fuel for running them and equipment for handling them.

The result of the Coolidge administration's handling of aeronautics has been to greatly retard and stunt its growth as compared to that of other nations. The one redeeming feature during this period has been the proved supremacy of aircraft in operations against naval vessels and as a means of transportation over land, and the remarkable flights made by some of our citizens across the Atlantic and the Pacific, in aircraft of primitive design, equipped with comparatively rudimentary instruments. Too much credit cannot be given to these men because without their pioneering spirit and daring our whole air development would have been retarded even more.

How should we organize our air power then, it may be asked? When we answer this, we are not groping in the darkness for a solution, but we offer one that has already been tried and is in effect in the great countries of the world.

There should be a Secretary of Aeronautics and under him three sub-secretaries, one in charge of experiment and research, one in charge of commercial aviation, and one in charge of military aviation.



One of the forms of the automatic pilot for guiding airplanes without the touch of human hands. This device is able to take an airplane off the ground, fly it through the air, change direction while in the air, and even land it.

The sub-secretary in charge of experiment and research would be specifically charged with producing the safest and most efficient airplanes for a particular use. In Europe, this department assists all the manufacturers with advice, with carrying out experiments which they are unable to make on account of the prohibitive cost; for instance, in the United States, the development of the gyroscopic automatic pilot which will fly an airplane by itself; the development of an anti-stalling device which will prevent the airplane from stalling and falling to the ground, the cause of 90 per cent of the accidents; the development of an altimeter which will show the height of the column of air under the airplane instead of the air over it, as at present. These things cost millions and millions to develop and push through and no commercial organization, no matter how wealthy, is capable of doing them alone and unaided.

The sub-secretary for commercial aviation would be charged primarily with developing airways to all points where air traffic is necessary. He would handle the weather service of the whole government and have weather data broadcast from radio stations every five minutes. The airways in the United States should be arranged along three principal routes, one through the north, one through the center and one through the southern part of the country. If aircraft ran into heavy storms on one of the airways, they could be ordered by radio telegraphy to another. The average storm is not over 200 miles in diameter and modern aircraft flying at high rates of speed can get around it safely.

These airdromes should all be equipped with devices for landing and taking off in the fog, bringing aircraft over the airdromes in fog, radio beacons and direction finders. Good fuel, spare parts and the aid of mechanics should be furnished at cost.

The United States, under an intelligent direction of its aeronautics, could airplanize the world just as it is automobilizing it now. This cannot be done according to present methods. For instance, when we returned from the European war in 1919, we attempted to have an aeronautical mission sent to China by the United States, also to other countries

(Continued on page 90)

XUM

Captain Einar Lundborg Tells

Swedish Royal Flying Corps

Captain Lundborg, who rescued Nobile from the ice, after the Italia disaster, tells the true story of the rescue, and so stills much of the criticism that has been based on incomplete information of what occurred.

WHEN the polar airship, "Italia," passed over Sweden in April, 1928, on its way to "the top of the world," I saw General Umberto Nobile, its commander, for the first time. I was then stationed with the Third Flying Corps of the Swedish Military Flying Service, located at the city of Linkoeping, in central Sweden, and was ordered with my machine to escort the aerial guest as far north as Stockholm.

As I flew quite close to the forward gondola of the "Italia," I made the acquaintance of the crew, although at the distance of several meters, and also saw the General's little dog, "Titina," which for the second time in its life was trying a flight to the North Pole.

The next time I heard of the airship was toward the end of May, when reports from Spitzbergen announced that it had probably been wrecked. Sweden, among other northern countries, quickly decided to send out a relief expedition. The Swedish unit, which was organized with volunteers, was to consist of two hydroplanes and one land plane on skiis. The flying equipment was loaded on a special ship, the "Tanja," to be brought directly to Spitzbergen, while the majority of the members of the expedition, including myself, were to go on board a Norwegian whaling vessel, "The Quest," chartered by the Swedish government for the purpose. We sailed on June 10.

The first land we saw at Spitzbergen at close range was a long, narrow island, Prinz Karls Vorland, which is situated west of the main islands, some 800 kilometers north of North Cape, in Norway. On June 19 we anchored in the inner cove of King's Bay where the little mining community of New Aarlesund is located. It was at this place that the Italian airship hangar was built and from here the last unfortunate journey was made. Out in the bay lay the mother ship of the aircraft, the Italian auxiliary cruiser, "Citta di Milano." When the "Quest" had anchored alongside of the Italian vessel, the chief of the Swedish expedition, Captain Tornberg, went on board to confer with the Italian commander, Romagna.

A few of us went ashore to look at the place. Some distance away from the village rose the naked hangar of the "Italia" like a huge skeleton: the outer covering had been removed when it seemed sure that the airship would not return.

As we were walking around, we suddenly heard the sound of motors. We knew that the Norwegian explorer, Roald Amundsen, was to be expected that day in a French Latham machine, as well as the Swede, Viktor Nilsson, in a Junker plane and the Italian flyer, Maddalena, in a Savoia. We hoped that it was the Swedish machine, but instead it proved to be the Italian plane that landed out on the fjord. The large, powerful craft really looked imposing out there, as it came driving along on the ice-covered water.

The sirens of the "Quest" called us on board again. The meeting between Captain Tornberg and Commander Romagna had given us a general idea of what had happened at Spitzbergen. The airship "Italia" had struck bad weather with storm and cold fog on its return from the North Pole. Partly due to the ice formations and partly due to the loss of gas, the ship descended to a low altitude. It struck against the towering pack ice and the front gondola was crushed, through which one man was killed but the remaining nine were thrown out on the ice more or less unharmed. The rest of the ship, after it had lost its gondola, rose again and disappeared forever in the strong wind.

Among those rescued from the catastrophe were the chief of the airship, General Nobile, and the Swedish meteorologist, Dr. Finn Malmgren. One of the radio operators of the craft, Biagi, was also saved and he succeeded in putting together a radio apparatus from the scattered material with which he established radio connection with the "Citta di Milano" on June 8. A few days before, the S. O. S. of the "Italia" had been intercepted, among other places, in the United States. A little tent found in the gondola became of great value and the provision packages which had been brought along as ballast proved of exceptional help. Three days after the disaster, the Swede Malmgren, in company with the Italians Zappi and Mariano, other members of the crew, left the camp on a march toward land to bring help.

The "Quest" now pulled up anchor and steamed further north. After a journey of eight hours we anchored between Amsterdam Island and the Danish Islands at the northwest point of Spitzbergen. The place was called Virgo, or André Port, and it was an historic spot to us Swedes. It was from this place that the Swede André in the year 1897 made an attempt to reach the North Pole in a balloon. It was sad to see the remnants of the balloon house, the gas machinery and other relics of the unfortu-

The Truth About Nobile's Rescue

Did General Nobile wish to be rescued first? Captain Lundborg's story gives the inside facts for the first time.

nate expedition, in which André had perished.

The "Tanja" arrived at noon with flying equipment from Sweden. Immediately we began to mount the hydroplanes. This proved an easy task. After only a few hours the two planes were in the air for trial flights.

Late in the evening of June 19 the Swede, Nilsson, landed with his three-motored Junker machine after a wonderful flight from Sweden. The Swedish government had decided after the expedition had started to add yet another plane to it. The following day the three hydroplanes went forth on their first scouting flight toward the Nobile group, whose position we had obtained by radio from the "Citta di Milano." After a flight of eight hours they returned, however, without having found the camp. The sea charts of Spitzbergen are very badly done, and therefore it is difficult to find a given spot by reference to them, even if one has the astronomic position.

Besides our worry about the fate of the Italians now came misgivings about the Norseman Amundsen, for the radio announced that he had started from Norway on the 18th and had not been heard of.

The land machine, a Fokker plane, which I was to fly, we began to mount on this day. The work was very difficult, since we had to transport the various parts of the machine across Virgo Bay, a distance of two kilometers, on a raft made of two life boats, to the edge of the Danish Island where the mounting was to be done.

On the 22nd the two hydroplanes made a second attempt to bring help to the Italian camp. While these machines were away, the mounting of the Fokker plane was completed and just as I landed after the first trial flight the hydroplanes returned.

When we got on board the "Quest" we were told by Captain Tornberg that the machines this time had had better luck. They had not only found the camp but had also been successful in throwing down from a low elevation by means of special parachutes a quantity of provisions, medicines, storage batteries, two inflatable life boats and two Swedish rifles with cartridges.

Before the machines started I had written directions in English on the packages, that if a suitable landing place was found near the camp this should be marked or indicated by the red parachutes.

And now on the very eve of midsummer an attempt was to be made to remove the shipwrecked "Italia" from the pack ice. The plan was as follows:

Two of the hydroplanes with Captain Tornberg and Lieutenant Jacobson as pilots, and the Fokker machine which I was to fly, were to start together at eight o'clock in the evening and fly eastward. At Hinlopen Sound which divides Spitzbergen into two equal portions, Lieutenant Jacobson was to land and locate a suitable place where both the hydroplanes and the land machine could come down and rise again as near each other as possible. Captain Tornberg and I were to continue eastward toward the camp of Nobile where I was to land, if possible, take up one of the men and leave him at the place which Jacobson had selected and thus continue back and forth until all the Italians had solid ground under their feet. Sharp at eight o'clock in the evening the three machines lifted and were soon on their way in close formation.

At Hinlopen Sound, Jacobson left us, as had been prearranged, and Captain Tornberg and I continued eastward. When we passed the Foyn and Brock Islands—we had now flown some 450 kilometers since we left the harbor of Virgo—immensely wide spaces of pack ice lay before us, as far as the eye could see. After flying northward another 40 kilometers, Captain Tornberg's machine made a sudden turn toward the right and there, to the left of me, right in the midst of the ice, I discovered a little tent, a thin spiral of smoke, a mast with variegated pennants, and a few men, one of whom waved frantically with a red flag. This was the camp of the Italians. Close by I noticed the red parachutes of the Swedes laid out on the ice. This was therefore my landing place. After circling about a few times, while trying the skiis of my machine on the snow and ice,

XUM

I landed. The tension was tremendous before the machine finally came to a stop, only a few feet from the barrier of the pack ice.

I taxied down the field to one of its short sides, where two men came to meet me, one being Viglieri, naval officer, and the other Biagi, noncommissioned officer and a radio operator of the airship. I immediately inquired for General Nobile and when I was told that he was at the camp which lay 200 meters away I began to march thither. It was very difficult to climb over the masses of ice and to jump over the many canals. But finally after almost half an hour's work we arrived at the camp.

I found the General sitting on a block of ice before the tent. Like the other Italians he was dirty and terribly unshaven and attired in a peculiar costume, a mixture of civilian and military clothes and Arctic garments.

I told the General who I was and asked him to be the first to follow me.

He objected and said that he had already decided on another order: Ceccioni, one of the crew, who had broken his leg, should be brought to safety first, and of the remaining, the General wanted to leave the camp last.

I repeated my request and stated that the General's presence on board the Italian base ship would be very desirable, for he could give important directions to the rescue expeditions which would later be dispatched if all the men of the camp were not brought away during that very night. Besides, I told him that my machine surely would not be able to rise from the small and very uneven field with both Ceccioni who was a very large man, and my observer, Lieutenant Birger Schyberg, in the back seat. Furthermore, it would take very much longer to bring Ceccioni over to the Fokker machine, as he had his leg in splints.

Tri-motored, all-metal Junkers, "Uppland," built in Sweden, piloted by Sergeant Viktor Nilsson.

The General thereupon reluctantly asked the opinion of his men and finally he consented to come along.

At last he was ready and we began our march toward the flying field. It took us nearly an hour to get there, for the General was also wounded in one leg. After Nobile, his little dog, "Titina," and my observer had climbed up in the back seat, I started. Was I to succeed to rise with my two passengers on the narrow and bumpy field? The Jupiter engine thundered in its characteristic way and the Fokker machine, gradually gaining speed, glided forward over the ice floe, covered with deep snow and many large, uneven chunks of ice.

Nearer and nearer we sped toward the tall, compact walls of the pack ice and again the tension was extreme. But at last, only some fifty feet from the threatening steel-blue barrier, the Fokker rose gracefully, cleared the dangerous obstacle and swept upward and westward to the Hinlopen Sound.

Over at the Russian Island, Lieutenant Jacobson had selected a splendid landing place where I descended.

The General was brought down to the shore where the two hydroplanes had landed. We put him in a good sleeping sack and refreshed him in the best manner we could; even the little "Titina" got her share of attention.

But I had to be off again, for about 200 miles eastward there were still five men who waited for me. Lieutenant Jacobson was to escort me this time, and I was to be alone in my machine in order to be able to take the heavy Ceccioni with me. During my absence he was to have been brought over to the flying field from the camp. I looked eagerly for tracks of my countryman, Malmgren, who a few days after the disaster had left the Italian camp to walk ashore, but, unfortunately, I found none.

Arriving at the Island of Foyn, my engine began to skip. I then decided to go down and land on this island, but apparently there was only a little dirt in the gasoline, for the motor picked up again and I continued toward the east. Lieutenant Jacobson and his observer, Rosensvaerd, led the way; I had only to follow at a distance.

Thus I arrived for the second time at the camp on the pack ice, and just as I shut off the engine to go down and land, it began to spit again. I now had no other choice than to make a forced landing and my only chance was, of course, the ice field. I was convinced that the landing would be accomplished easily, but the snow had become soft—it was now five in the morning and the sun shone warmly—and before I knew what had happened the right ski had dug itself deep into the snow causing the machine to turn completely over.

My first reaction was anger. I was terribly angry, and will not here try to repeat all the bad words I used. After I had loosened the straps and slid to the ground, I got out from under the somersaulted plane. Some of the Italians came toward me and, as was expected,

(Continued on page 82)

Captain Tornberg, leader of the Swedish Nobile Rescue Expedition.

Lieutenant Birger Schyberg, who rescued Lundborg in a Moth plane.

A class in aeronautical engineering at the California Institute of Technology.

The pilot is Richard H. Woods, sophomore in electrical engineering at Kansas State College.

Aviation Has a Place for College Men

By R. N. Miller

AS another high salaried, specialized field for trained men, commercial aviation is playing right into the hands of America's college students.

At present the new flying industry faces a serious personnel problem. Not only pilots, but trained engineers, factory craftsmen, purchasing agents, salesmen, and many others are needed for the hundred odd diversified capacities entailed in aircraft manufacture and operation.

Hence the efforts of aircraft manufacturers to attract men from the university campus. Until recently, the conventional college student made a very superficial study of the new industry, and turned to more established fields. Like the rest of the public, they were unprepared for its sudden zoom out of the downdrafts of apathetic public interest and tight credit. As the summer of 1929 unfolds, the situation is vastly improved.

Few people nowadays smile at the mention of a commercial aircraft industry. An increasing value of aeronautical securities emphasizes the solid structure behind the business. The enormous size of many new operations is still a bit breath-taking. The huge plants which manufactured 4,000 planes of all types and sizes in 1928 will approximate 10,000 ships in 1929.

A recent report by one of the large Eastern Guggenheim schools illustrates the present personnel situation. Six months before graduation, every senior aeronautical engineer in the school had been hired at a handsome salary. Chief engineers of a score of factories make regular trips to solicit sorely-needed assistants.

Particularly imperative is the need for trained designers, stress analysts, draftsmen, etc. Before a new plane can be produced for the market, months of preliminary work are required on the part of the engineering force. Every rib, truss and component part must be drawn in preparation for standardized production. The proposed plane is thoroughly analyzed to determine the stresses to be undergone in all conditions of flight. If unsatisfactory to the Department of Commerce, the plane must be re-designed and the stresses rechecked before the type can win the necessary license.

At the present time a sad dearth of engineers and draftsmen is resulting in tantalizing delays before the production of improved airplanes and motors. The consequent dollar loss is, in many cases, tremendous.

Nor is the shortage confined to the engineering departments. Industrial aeronautics unfolds a spick and span new field, not only in aerial transport, but as an auxiliary to many older, established industries. On every hand development is hampered by the lack of trained men. To a certain extent, however, the latter situation is improving. By means of campus flying clubs hundreds of collegians are acquiring aeronautical knowledge as supplemental training for important posts in the specialized air industry.

It remained for an established aircraft manufacturer to sound out the depth and scope of this college field. Struck by the scarcity last summer, J. Don Alexander, president of the Alexander Aircraft Company, decided on immediate steps to divert a ready supply of trained men into his industry. The first move was to tap the constant, collegiate reservoir of progressively intelligent young

XUM

men. Until aeronautical subjects become standard on the collegiate curricula, some stimulation was felt necessary.

The upshot was the offer of valuable incentives for young college men to consider aviation as their chosen field, or at least study the advantages of aircraft in relation to other commercial industries. These awards were a four-year university scholarship in aeronautical engineering, business aeronautics, or a complete Eaglerock airplane. The winner will have his or her choice.

The scholarship was established in the Guggenheim school of aeronautics at New York University, and its head, Prof. Alexander Klemin, became chairman of the Alexander Eaglerock committee on awards. Until May 1 every regularly enrolled undergraduate in America was entitled to a whack at the scholarship or the Eaglerock. The winner will be announced June 1.

Men and women of 193 colleges were entered in the competition on March 1 and the list rapidly mounted. Of greater importance to the contest sponsors than the mere number of entries, was the diversified character of the competing students. They were enrolled in business administration, law, agriculture, medicine, theology, aeronautical engineering, mechanical engineering, electrical engineering and a dozen other courses.

More than a hundred students admitted that they entertained no intention of entering the aero industry itself; rather they expected to use aircraft as a valuable accessory in their chosen field. This rising crop of air-minded business and professional leaders means more to the flying industry than any number of daring trans-oceanic flights.

For instance, a contestant from Oregon State College reveals a new and promising usage for commercial aircraft. This young man, a student in agriculture and part-time operator of a large hatchery, is studying aviation with a view of using aircraft for the rapid transit of baby chicks. As train transportation takes a serious toll among new-born chicks, air travel is expected to solve the problem.

Another student, a pre-medic in a middlewestern university who contemplates a country practice, wrote that he was learning to fly so as to render his future patients the best possible service.

A student in geological engineering at the University of Oklahoma declared his intention of using aircraft as much as is practical in his profession, and he enumerated many such means. He pointed out that airplanes are now an efficient means of determining the geological character of large areas of difficult country. A trained observer can read volumes from an enlarged aerial photograph. Aircraft aid the surveyor not only as a means of observation but by transporting him swiftly and economically over uninhabited and barely accessible lands. Large areas of Alaska are wielding their secrets to the flying geologist and engineer.

Civil engineers of several scattered schools recommend aircraft as a means of rapid, accurate surveys for pipe line, highway and railroad routes, dam sites, etc. Specialists familiar with both flying conditions and surveying are particularly needed in this field.

Electrical engineering students are watching closely the experimental patrol of important transmission lines by airplanes in sparsely settled country. In winter, when deep snows make travel toilsome and often impossible, a large western power company has utilized local aircraft to hurry men to serious breaks in its main line. Electrically inclined students also see possibilities in the newly-developed advertising medium of night-flying electrical billboards and flying broadcasters.

J. Don Alexander, donor of the scholarship and awards to college men.

A former marine radio operator now enrolled in electrical engineering at the University of Oklahoma is studying to become radio expert for large air transport and passenger lines. This work will require a familiarity with aeronautical problems as related to radio transmission and reception. As radio is solving the cross-country weather problem, college trained radio men and electrical engineers will fill a very definite need in promoters.

A Princeton student, born in Montevideo the son of an auto exporter, declared that South America offers an unusually fertile market for American aircraft. After his graduation he will learn to fly and acquire aeronautical knowledge enabling him to direct aircraft exports to these countries, or handle a big foreign agency. South America also makes a good field for aggressive air transport promoters.

A Denver University student stated a broad truth with admirable clarity in his letter of application. "Safe flying," he wrote, "is a mathematical certainty if the rules are followed. The adverse publicity occasioned by lax piloting is the greatest problem in the industry today."

An experienced army reserve flyer now studying architectural engineering at Columbia University is specializing in the planning and construction of modern airports. This brand new field is wide open to technically trained men with a knowledge of flying conditions, airport drainage, design, and location. Every municipality of any size will soon retain trained aeronautical architects to supervise airport establishment and development.

A New York University law student predicts that large mergers will soon become the order of the day among leading air transport and manufacturing companies, as they now are among automobile and railroad concerns. By virtue of an extensive aeronautical training on the side, he will on his graduation be equipped to handle big consolidations, or serve as public relations counsel to air transport lines which must be careful of their public relations or suffer the strict governmental control in effect over other public utilities.

Nor do journalism students lack for opportunities in commercial aeronautics. A trained aviation editor is, or will soon be, a standard member of the daily newspaper staff. The specialized nature of the field is made to order for free lance and trade writers. Good use can be made of advertising men whose originality is equal to the romantic and advanced character of aviation.

The contest revealed a surprisingly large number of army and naval reserve pilots enrolled in colleges. With a business education to top off their flight training, many of these young men will eventually become executives of future air transport lines.

The position of commercial pilot warrants the deepest consideration of college students. The profession calls for far less time and money in preparation than that of physician or lawyer, and yet a good commercial pilot as a rule will earn more than a man of the same age who is engaged in the other two fields. In view of the growing demand for good flyers and the rising salary scale, it can safely be said that one of the wisest investments open to a young man today is a commercial flying course.

The aeronautical engineering student is fully aware of his prospects. When trained, he is assured of a lucrative posi-

(Continued on page 100)

Where Does Weather Come From?

By M. Luckiesh
Lighting Research Director
National Lamp Works of General Electric Company

PRIMITIVE beings believed that weather was manufactured in some mysterious places by equally mysterious super-beings. If we are to believe Grecian and Roman mythology this idea was still quite prevalent after mankind had progressed far in many other directions. With the beginning of modern science a few centuries ago these super-beings who supposedly manufactured winds and thunderbolts began to be pushed into the background.

Scientific men began to have glimpses of natural laws behind natural phenomena. Knowledge has grown rapidly but there still persists in the minds of many persons something of the primitive ideas pertaining to weather. Others may frankly disbelieve that the weather east of the Mississippi River comes from Medicine Hat for to them its source is shrouded in mystery.

Notwithstanding the apparent anomaly, the more we know the more there remains to be known. In other words, knowledge increases in an ever-widening circle, but the boundary between it and the wilderness of the unknown simply advances. There is much unsolved in regard to weather, but many foundational facts and details of the structure of meteorology are available.

Weather is the result of many influences complexly interwoven, but some of these can be traced backward more and more toward the foundation. Few persons could answer briefly the query which forms the title of this article. It may interest the reader to pause for a moment to see if he can.

The author has been asked this question many times and has given the rather prosaic answer, "Temperature-difference." Whether we view the circulation of atmosphere locally or generally we trace the beginning of its movement to unequal heating of different portions of it. As the temperature of air increases its density decreases—it becomes lighter. Through the attraction of gravity the heavier or denser air is pulled toward the earth, thus displacing the lighter or less dense air. The latter moves upward.

This is the beginning of weather. If the atmosphere was in a perfectly stable state it would be quiescent. There would be no movement—no eddies, no winds, no changes in humidity, no rain. There would be no weather and the climate would be perfectly uniform.

Viewing the effect of temperature-difference upon the general circulation of the atmosphere we first consider the equator and the poles. Owing to the sphericity of the earth we have the surface at the equator receiving a maximum heating effect from the sun. This heating effect diminishes toward the poles and, owing to the increasing declination of the earth's surface in respect to the direction of the solar rays, the heating effect diminishes more and more rapidly with increasing latitude.

From this condition alone air rises at the equator and would flow directly north and south to the poles if the earth's surface were of uniform composition and if the earth were stationary. But the earth's rotation deflects the south-north circulation to the right and the north-south circulation to the left. Therefore, in both hemispheres the earth's rotation gives the circulation an easterly component.

The air rising at the equator to flow toward the poles is replaced by a surface current flowing toward the equator.

Next to be considered is the composition of the earth's surface. The first obvious division is into areas of land and of water. We have the great oceans and the great continents. These absorb radiant energy from the sun unequally.

In the torrid zone the earth is generally hotter than the water and, therefore, air at or near the surface of the land becomes hotter than that close to the surface of water. Hence, it rises over these land areas because the force of the earth's gravitational pull draws the heavier air downward which pushes the lighter air upward. Therefore, from this cause alone we have a sea breeze most of the time—movement of the lowest layer of air from sea to land. If at night the land eventually cools to a temperature

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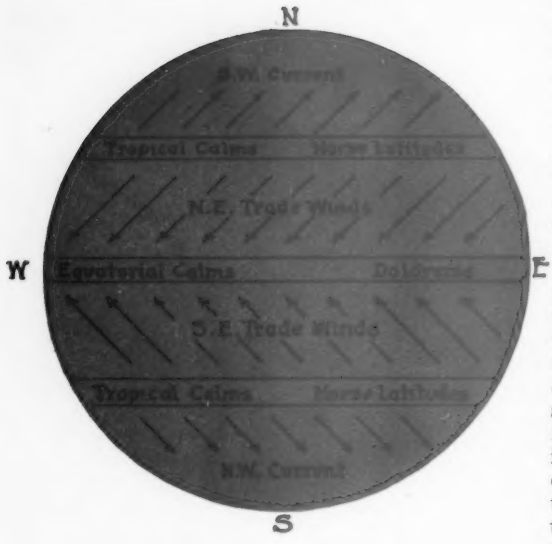


General Direction of Winds at Earth's Surface

operative it is obvious that calms are the unusual condition of the atmosphere near the earth's surface. Of the three primary influences of the general motion of the atmosphere, two are caused by different amounts of heat in various portions of the atmosphere. The third—the deflecting effect of the earth's rotation—would be inoperative if the other two did not exist. Therefore, it is seen that the non-uniform heating of the air is the fundamental basis of all atmospheric motion and this in turn is the beginning of all weather. Climate is the sum total of weather in any locality.

Certain characteristics of the general circulation of the atmosphere are now well known and traceable to definite causes at the basis of which is temperature-difference. Some of these to be fully explained require tracing the air-currents from the equator to the polar regions and back. These are devious routes influenced by conditions not yet discussed, but the general movements are definite and readily understood.

Excepting for the doldrums in the tropics the winds are generally easterly at the earth's surface and westerly at altitudes from two to four miles.

The westerly winds of the temperate zone are also generally recognized. These also extend into the polar regions and the velocities of the upper air increase in the temperate and polar regions. At great altitudes at which airplanes are able to travel the winds are generally westerly and the velocities are generally greater than at the surface of the earth. However, these conditions are by no means constant.

An understanding of the effect of temperature-difference upon the general circulation of the atmosphere is helpful in visualizing the causes and effects of less general—local—movements of air. Furthermore, a view of these great air-currents relieves one of the shut-in feeling when considering the less general conditions which are actually of more importance to aviation. These two reasons are sufficient for dwelling somewhat upon the great air-currents.

Owing to the generally maximum heating effect along the equatorial belt there is a barometric low. That is, the total weight of the atmosphere per square inch of earth's surface is less than along the belt of higher pressure somewhat north and south of the equator. Throughout this equatorial belt the barometric pressure is practically uniform excepting for slight daily changes.

In other words, over this great area appreciable barometric gradients do not exist and, therefore, there is little or no tendency for the air to flow. At best the breezes are fitful. These are the great permanent calms, known particularly to the sailor as the doldrums. Here the weather consists of cloudiness, rain, thunderstorms in more or less continuous sequences.

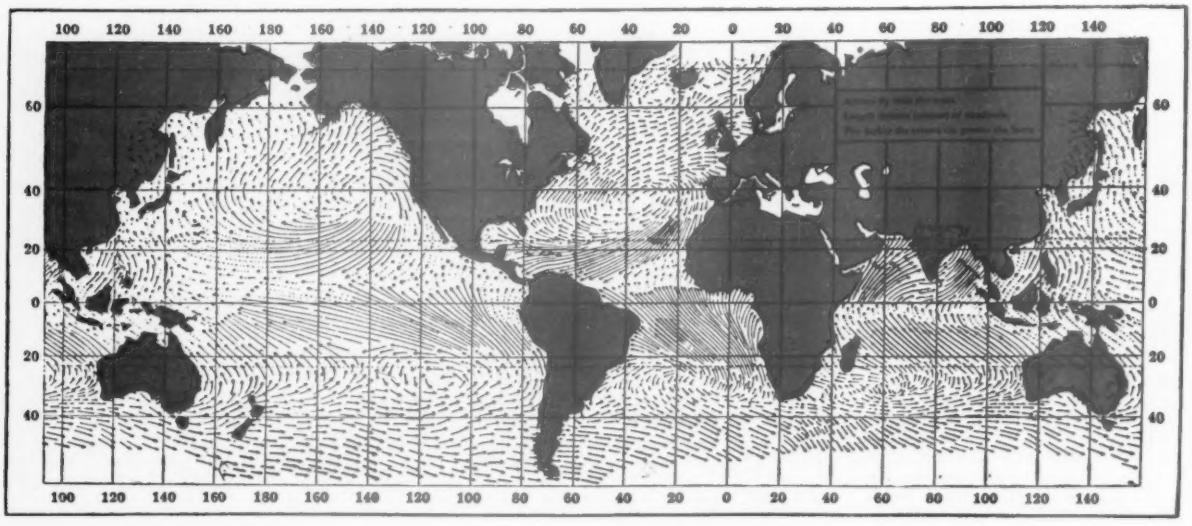
Further north and south the tropical belts of higher pressure give rise to steady breezes toward the equatorial belt of low pressure. These are the trade winds which blow almost constantly

below that of the water the breeze may be reversed in direction.

As we proceed further north (or south) of the equator this reversal at night becomes more certain and finally in a large part of the temperate zone we have not only daily reversals but actual seasonal reversals. During the summer, sea-breezes are prevalent over land areas adjacent to the oceans and in winter the direction is reversed. Thus the seasonal winds—monsoons—come into being. They are the product of non-uniform heating by or non-uniform absorption of solar radiation. Their effect extends upward to the lower and intermediate cloud region.

Since these disturbing influences are always

Winds over the ocean during midsummer in Northern Hemisphere and midwinter in Southern Hemisphere. Arrows fly with the wind, length indicates steadiness, blackness indicates strength.



from the northeast in the northern hemisphere and southeast in the southern hemisphere.

In midocean areas these surface winds are nearly easterly but in the eastern half of the Atlantic and the Pacific oceans the direction gradually shifts toward the poles; that is, they tend to become northerly in the northern hemisphere and southerly in the southern hemisphere.

Although the trade winds are noteworthy for their slight variation in strength and direction over long periods they are not strictly uniform. They are steadiest in the south Atlantic and South Indian Oceans. They are generally more brisk in winter than in summer. Among the islands of the South Pacific they are somewhat deformed and they practically disappear in January and February; that is, in midsummer. Ordinary cyclonic storms do not disturb them, excepting in the western portions of the oceans and this disturbance is more or less superficial and confined to late summer and autumn.

On the outer margin of the trade winds, approximately along the ridge of the high-pressure tropical belts of both hemispheres the barometric or pressure gradient is more or less irregular. This results in prevailing winds, uncertain in strength and in direction. The region is somewhat similar to the calms of the doldrums excepting that the weather is generally clear and the calms are more or less intermittent rather than fairly continuous as they are in the equatorial belt of low pressure. These are the Horse latitudes as they are known to the sailor.

North of this region in the northern hemisphere (and south in the southern hemisphere) the barometric pressure again diminishes toward the pole. This causes winds to blow toward the pole but, owing to the deflection to the right in the northern hemisphere due to the earth's rotation, the winds are southwesterlies.

In the southern hemisphere the winds in the corresponding region are northwesterlies—that is, from the northwest. As they proceed north (and south in the southern hemisphere) they become the prevailing westerlies of the temperate zones.

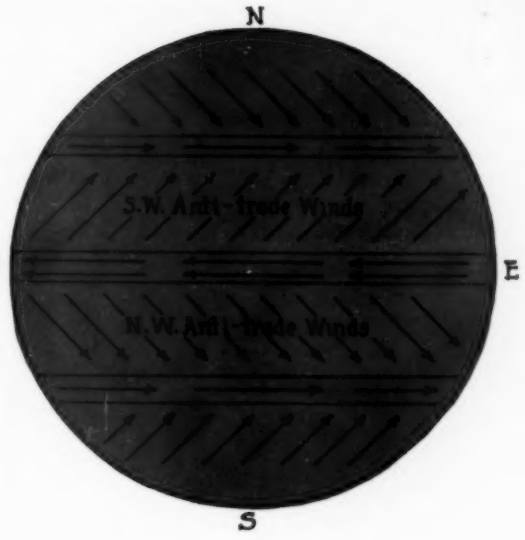
Thus we have had brief glimpses of the general circulation of the atmosphere which are more or less constant due to the underlying cause of temperature-difference over great areas of the earth. These primary earthly factors become influenced by continental and oceanic factors all traceable to unequal heating or cooling and form the foundation of weather. Then, as we proceed to narrow the range of our view to localities, we find other influences of a similar character but smaller in sphere of influence.

By this process we analyze step by step while we decrease our range of interest geographically and we learn to analyze the causes of local weather and arrive at an understanding of them.

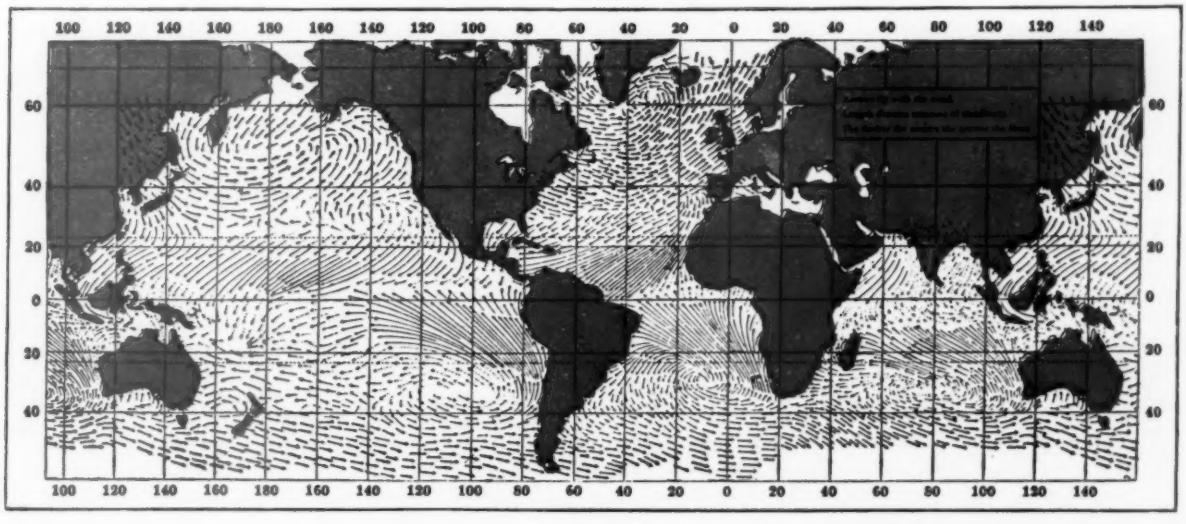
Now let us view the United States. The great Southwestern desert impresses us as a place of scanty rainfall, clear skies and hot weather. The temperature-difference between it and the relative paradise in which most of us live is perhaps the most impressive aspect of this desert. However, it became a desert due to temperature-difference which is the fundamental cause of winds, weather and climate, although this cause has a copartner or secondary ally in the configuration of the earth's surface. Some cataclysmic prehistoric event left a great wrinkle in the earth's surface which man has named the Sierra Nevada range.

The continental area occupied by the United States becomes hotter in the summer, at least, than the surface water in the Pacific Ocean. The layer of air near the earth's surface rises and there is a tendency for the lower air over the ocean to replace it. Besides all this, in the great system of winds,

(Continued on page 85)



General Direction of Winds at High Altitudes



Ocean winds during midwinter in the Northern Hemisphere and midsummer in the Southern Hemisphere. (Koppen.)

Pilot Trouble

By Lieutenant Benson Hoy

Believing that confession is good for the soul Lieutenant Benson Hoy, U. S. N., has a few things to say about newspapers and their accounts of accidents. He does not declare engine trouble to be non-existent, but he has his doubts—

SINCE Lindbergh's hop to Paris the statement is frequently heard that the American Public has become air-minded. Despite the welcome publicity aviation has received, commencing with Lindbergh's exploit, the American Public is *not* air-minded. It is merely air-conscious. To counteract the quantities of space given to describing some record flight, there is still an effective amount of misleading newsmatter appearing in the daily papers.

Despite the front page stories that follow some daring trans-ocean flight, aviation reaches the front page most frequently "by accident," and the apparently large number of accidents one reads about is responsible for the prevalent belief that flying is a dangerous and hazardous performance.

When the American Public can learn to see through the vagaries and limitations of a reporter's mind, then it will be really air-minded. Perhaps when that time comes—let it be soon—reporters will also have learned something about aviation.

Ask yourself this question and try to answer it with your newspaper education: What causes most of the accidents in aviation?

You very likely think that motor failures (to be technical, the thing that makes the noise is the engine) and planes getting out of control, are two causes mainly responsible. But neither of them by themselves has caused more than one or two accidents a year. Newspapers, however, would lead one to believe that nearly all accidents are the result of some unexpected eccentricity or failure of engine or plane. It is news to relate how an uncontrollable impulse of a plane caused a crash; but no one is very much interested in another mistake made by man, who has been making them since Adam graduated from the Garden of Eden.

With few exceptions, accidents from motor failure or planes getting out of control are caused by a pilot's error in judgment—known as "pilot trouble" in aviation parlance.

Here is an example of how pilot trouble results in an accident. The form of crash to be described is a common one and combines the engine failure and "uncontrollable plane" features so often headlined.

While flying over Municipal Field, John Smith's engine suddenly quit on him. (Engines almost without exception will give an attentive pilot plenty of warning that they do not choose to run much longer. But Smith's engine stopped without warning, or perhaps Smith didn't notice the warnings.) He had 1,000 feet altitude over the field, which for a good pilot would be sure protection against a bad landing.

Smith, however, had forgotten which direction the wind was from and peered over the side to find it, with the subconscious thought that by doing so he was showing rare presence of mind in an emergency. (Pilots that lack confidence sometimes nearly break their necks making sure they land into the wind. Good pilots can land in any direction at all with safety.) Before peering over the side Smith put his plane into a safe glide, thus avoiding a stall, a mistake sometimes made that results in an immediate spin. The pilot who would fail to nose down with a "dead stick" (engine stopped) would also go haywire in the spin and forget how to right his plane. But Smith had read the book and nosed over in a proper glide.

By the time he found the wind, however, the ground was only 700 feet away and he was headed down wind, away from the field. By turning quickly he might glide back to the field, so he banked up in a turn. Now, Smith be-

XUM

Versus Engine Trouble

gins to doubt very much if he can make it. In the middle of the turn he notices the ground is alarmingly close and the field is farther away.

To lengthen his glide, Smith eases back on his stick putting the nose higher. A warning waver in his wings is unnoticed, every faculty being suspended by a single concentrated desire to reach the smooth ground of the landing field.

Another more dangerous wobble of the wings which is unnoticed again, is the beginning of a spin. Smith at this moment develops a hot box in his mental gears, and instinctively tries to right the plane by hauling the stick back.

This action makes inevitable what could have been checked even after the wobble. Another aviator falls in a spin. Unfortunately for Smith, a spin from three or four hundred feet has more serious results than one from higher up.

To a person really air-minded, this accident would be significant of nothing except that Smith should have known better. Poor John Smith would be consoled, however, if he could read the newspaper accounts of his crash. Here is a typical description: "John Smith, the intrepid Westville birdman, was critically injured in an airplane accident at Municipal Field. His motor stopped without warning, forcing him to bravely attempt to bring his plane down safely. With the motor stopped, his plane became uncontrollable and s u d d e n l y swooped to the ground."

If an engineer wrecks his train by running past a danger signal the papers get the news straight. But I have never yet read where a John Smith crashed from breaking a cardinal rule of aviation, or that John Smith was a poor pilot, inexperienced, dumb or l a c k e d inherent adaptability for flying.

Now, let's suppose John Smith was a better pilot and see what happens. In the first place he wouldn't have gone beyond safe gliding distance from the field. But we will put him in the same turn that proved disastrous to the less skilled pilot.

When Smith sees there is some doubt about reaching the field he looks the situation over while completing the turn. On his left are clumps of trees and a few stumps, dead ahead on his line of approach are several parked automobiles filled with people; to the right the ground adjoining the field is covered with low willow bushes.

The situation is perfectly clear: if Smith cannot make the landing field itself the only alternative is the open space covered with bushes. There may be a momentary uncertainty in Smith's mind as to whether or not he can reasonably expect to clear the cars and the fence at the end of the field. Within a few seconds, however, it becomes apparent that unless the glide is flattened it will be impossible to set the ship in on the field at all. This is the point where a clean-cut decision is absolutely necessary. Instead of attempting to prolong the glide a little, still in the vain hope of clearing the obstructions, our pilot eases the stick forward to insure sufficient speed for a cautious turn.

Smith veers over to the right and squashes his plane down in the bushes, injuring only the fabric covering his lower wings.

By using imagination the papers can make a front page story out of this. The most harmful influence from which aviation suffers is the newspaper tendency to exaggerate for the sake of news. A usual front page headline for an incident like the above would be: "Falling plane endangers spectators" and then would follow a lot of hackneyed bully-whack about pilot escaping death and narrowly missing automobiles parked on edge of field, and so on, in phrases with which you are familiar.

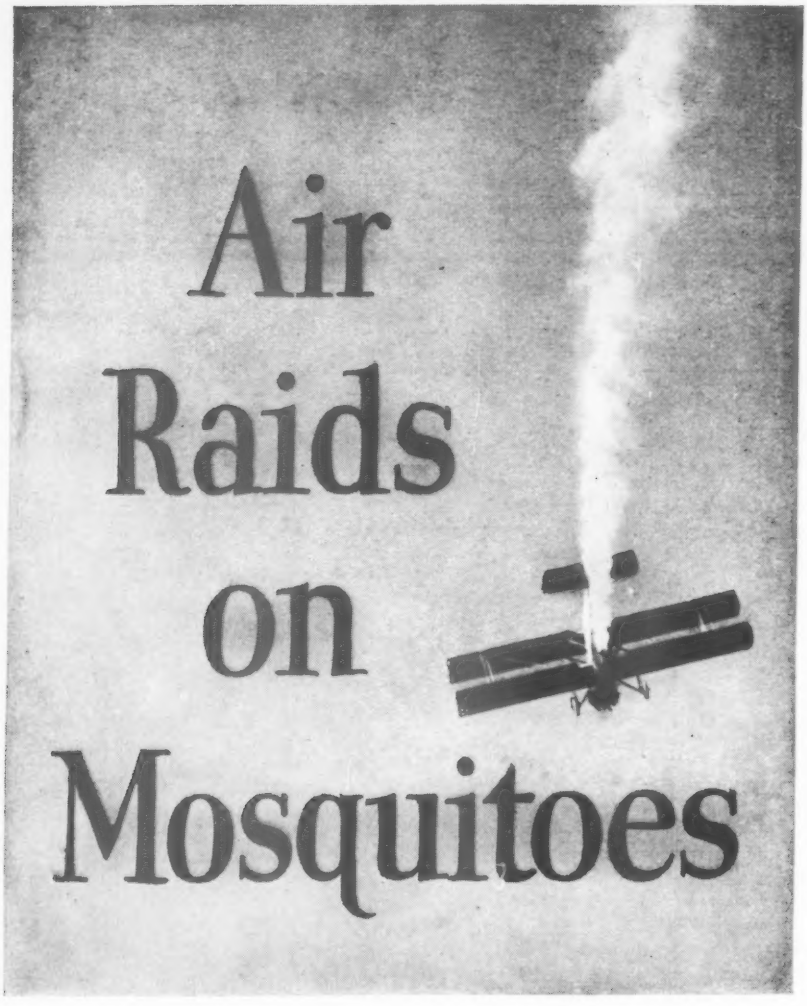
Dissatisfaction with American newspapers probably began with the first one printed, but the aviation world is justified in a feeling of annoyance. It may seem odd to newspaper men that an aviator who may not know whether France or Germany will win, who may not indeed know anything at all about politics or anything else, is nevertheless exasperated at the aeronautical chivel in the papers. In support of this critical attitude are numerous proofs—probably some in today's paper.

According to popular fantasy, I have had a couple of hair raising experiences. A bad landing in a flying boat damaged a wing somewhat. The landing was related to the daily readers as follows: "While flying low over the Mississippi the plane was seen to suddenly develop wing trouble." There was trouble all right, but I'm ashamed to explain where.

Another time I was taking off from a bumpy field when a wheel rolled off the axle. The rough ground seemed to account for the slight warning dip the plane gave that the wheel was leaving, otherwise I would have cut the switch

(Continued on page 99)

"Developed wing trouble—swooned and crumbled to the earth."



By S. R. Winters

FLYING low over swamps, marshes, and other mosquito-infested areas, seaplanes are being used for scattering clouds of poisonous dust onto the breeding-places of malarial mosquitoes. These air attacks against the germ-carriers of malaria fever involve the distribution of a mixture of Paris green and powdered soapstone—half and half, in proportions—on the dense vegetation and undergrowth sheltering the breeding-ponds of the insects.

The larvae of the malarial mosquito, feeding as they do on the surface of the water and partaking of hearty meals at brief intervals of two to four hours, devour the death-dealing dosages of Paris green. Their destruction is wholesale.

The dusting of mosquito-infested swamps from seaplanes, following a 5-year experimental effort, is now recognized as a definite and permanent Government project. The Bureau of Aeronautics of the United States Navy Department maintains at Quantico, Virginia—headquarters of the fighting marines—a seaplane equipped with metal hopper, with a sliding valve opening into a Venturi tube below the fuselage, for the specific purpose of spreading poisonous dust on mosquito breeding-places.

The swamps in the vicinity of Quantico are subject to these sweeping air attacks and similarly equipped planes are loaned occasionally to other branches of Federal and State governments for dusting operations. For instance, the Public Health Service of the United States Treasury Department, in cooperation with the South Carolina State Board of Health, has successfully demonstrated the use of the flying machine as a foe to the mosquito.

More recently, the Marine Corps of the Navy Department launched a sweeping air attack against a mosquito-infested area in Nicaragua. The dusting of Paris green from aircraft to control the breeding of mosquitoes was introduced five years ago by the Bureau of Entomology, United States Department of Agriculture, in the marshy areas of Louisiana.

A light metal hopper, containing 300 pounds of insecticide, was built in the rear cockpit of the plane and the poisonous dust was released through an opening in the bottom of the fuselage onto the insect-infested swamps. This experimental effort, by the very daring nature of the innovation, was attempted in the face of much skepticism.

It was classified as a publicity "stunt" or a feat for exploitation by motion-picture producers. It fell into the same category, at least in the mind's eye of the public, with the subsequent undertakings of disintegrating river ice-formations by dropping bombs from airplanes or the more recent spectacular demonstration of the transfer of postal matter from an airship to a train. But the novel undertaking of arresting the multiplication of malarial insects, after five years of experimentation, has proved its value as a project of enduring recognition.

It not only offers a wholesale control

method of carriers of the malaria-fever germ but these dusting operations, strange as it may seem, may prove an ally in hastening the development of hydro-electric projects in the South.

The impounding of water for the development of hydro-electric plants in the Southern States renders necessary the clearance of the dense undergrowth in the area surrounding these power-generating plants. State laws require the application of oil or Paris green on these mosquito-infested swamps and the ground methods of application are tedious, costly, and time-consuming.

If these State statutes could be modified, the seaplane could be introduced as a distributor of Paris green and the costly undertaking of clearing the undergrowth could be avoided.

Captain H. C. Major of the Bureau of Aeronautics, who is a pioneer in introducing the dusting operations against mosquitoes, cites an illustration to the point. To develop an area one-half mile long and four miles wide, by the conventional clearance methods, would require an expenditure of $750,000. By the air method of applying the Paris green on the undergrowth, the interest on the $750,000 would be adequate to the purchase of a plane, the equipping of it, and the hiring of a pilot for the dusting operations. Thus, the impounding of water for such a hydro-electric development would be simplified, cheapened, and hastened to a completion.

"Due to tremendous and rapid development of hydro-electric impounding in the South," to quote Dr. L. L. Williams, Jr., a surgeon of the U. S. Public Health Service, "it has been necessary for the various State boards of health and malariologists of the Public Health Service to give serious attention to the possibility of the use of the airplane in controlling *Anopheles* (the malarial mosquito) production in these areas."

Consequently, the South Carolina State Board of Health sought a practical demonstration. A Ford transport monoplane, from Anacostia, was loaned by the Bureau of Aeronautics for the cooperative project between the Federal and State public health services. The dust-distributing equipment on this plane consisted of a plain metal hopper with a sliding valve opening into a Venturi tube below the fuselage—for discharging and distributing by air suction the mixture of powdered soapstone and Paris green.

The transport monoplane was loaded with 500 pounds of Paris green and an equal quantity of soapstone. The machine, soaring only fifty feet above the tops of the trees, covered the 500-acre South Carolina pond in two flights, with 500 pounds of poisonous dust at each trip. A slight breeze, barely perceptible, was blowing, and the day was fair and bright. The plane made successive trips across the pond, grid-ironing it with swaths only one-eighth of a mile apart. The dust was distributed with a surprising evenness over the 500-acre area. The time consumed, including landing and reloading of the plane, was only one and one-half hours.

Spectators at this pond had, immediately preceding the flight dusting operations, removed any doubt as to the existence of mosquito breeding-places in the pond. Carrying dippers, these curious visitors had literally scooped up mosquitoes-in-the-making—eleven out of every thirteen scoops with a dipper producing larvae.

After the flight had been in progress for two hours, the spectators again reentered the pond and dipped for young mosquitoes. Within the cleared spaces of the pond, only dead larvae were produced. In areas clustered with trees and undergrowth, many larvae were found dead—in fact, all full-grown ones had succumbed to the death-dealing poison—and only the first-stage larvae remained alive.

With the elapse of 22 hours, after the dusting operations, the sanitary engineers and representatives of the Public Health Service sought to determine the mortality rate after the air combat. Cruising about the 500-acre pond in two boats, these Federal and State officials penetrated areas where the vegetation was densest and the floatage heaviest.

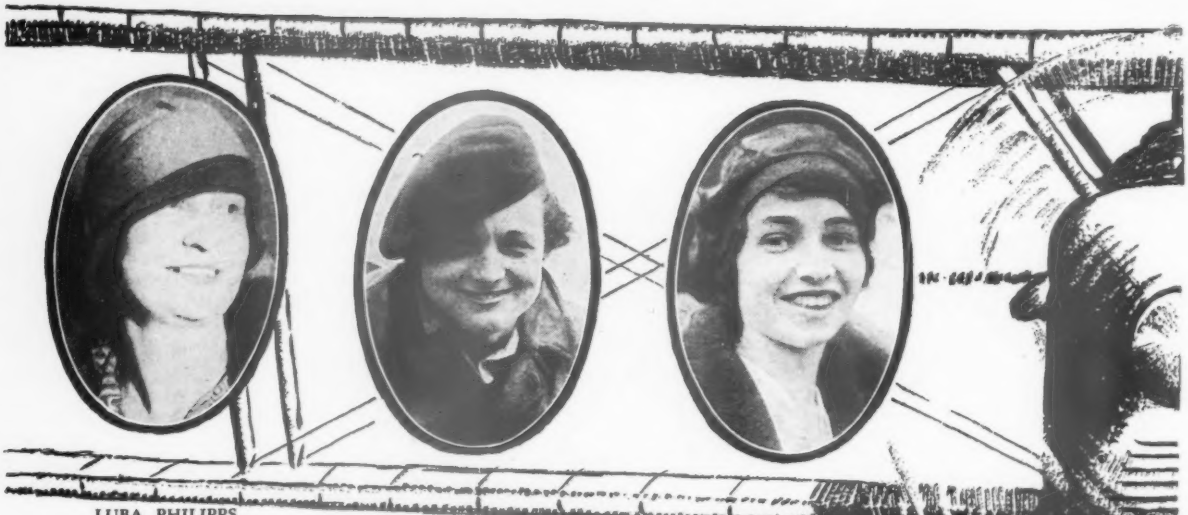
With intensive coverage of twelve acres in the lower section of the pond, scooping a dipper into the water 703 times, only three living mosquito larvae were found, while 84 dead ones and six living pupae were recovered.

A German scientist, while in this country, investigated the efficacy of this method of treating mosquitoes, and apparently was skeptical as to the penetrative effect of Paris green when scattered from aircraft. At Quantico, this visiting scientist was invited to place the larvae of malarial mosquitoes in a pan and deposit the latter in the densest undergrowth available in the swamps around the headquarters of the fighting Marines.

Then, to remove this skepticism, a seaplane flying low over the bushy undergrowth where the pan of larvae was concealed, sprinkled Paris green in the usual death-dealing doses — the larvae were killed and the Doubting Thomas convinced as to the efficacy of the air raid upon mosquitoes.

The airplane has thus become one of the most effective agents for controlling malaria infection.

N B type aircraft converted into mosquito duster, using arsenic preparation near Brown Field, Virginia.



LUBA PHILIPPS

LOUISE McPHETRIDGE THADEN

KATHERINE STINSON

Modern

HARRIET QUIMBY

WHEN Louise McPhetridge, after her twenty-two hour flight over California, said that women would soon be threatening men's records, some of us who have been observing the development of aviation since its pioneer days took more than passing interest. Is that, after all, possible? Are we to have winged Amazons?

The present observer, who was a chronicler of aviation when the amazing Harriet Quimby appeared, nearly two decades ago, frankly doubts it. And yet—

Flying women first appeared in the Norse sagas. The Valkyries ferried the souls of slain Viking warriors to Valhalla, and there attended them at their banquets. This heroic myth has been enshrined in the greatest flying-music ever written. And Wagner composed The Ride of the Valkyries more than a quarter-century before the advent of the mechanical wing. Passenger planes now drone their way over the German graveyard in which he lies buried.

The inner ear has a way of attuning itself to the monotone of an airplane motor. In this way I was listening to The Ride of the Valkyries one stormy evening in an express plane which was roaring with open throttle from Koenigsberg to Moscow. The face of a woman passenger of northern type caught my eye as a flash of lightning lit up an expression of almost ecstatic enjoyment. It contrasted sharply with the grim look of the pilot, whose straining eyes peered anxiously through a rain-drenched windshield for an opening in the clouds.

The woman of the North seemed a spiritual descendant of the Valkyries. She must have known that the next flashing crash of thunder might be the last she would ever hear, but the pounding of Thor's hammer in the clouds apparently was music to her. The pilot had been a warrior of the air, in the fighting between the Russians and the Germans; he bore visible scars of it; now he was intent on driving a storm-tossed plane through to Moscow instead of Valhalla. This time the Valkyrie was a passenger instead of a heavenly-transport pilot, and she seemed to be getting a lot of fun out of it, leaving worry to the warrior.

Women have been travelers of the air, many of them pilots, for almost a century and a half. Madame Thible ascended in a Montgolfier balloon—one of the first—from Lyons, in 1784, the year following the first authenticated ascension by men. . . . . The new American republic across the Atlantic was only in process of formation. Its ambassador to France, Benjamin Franklin, was also becoming the first American aeronautical reporter.

In the century that followed the pioneering of the balloon many ascensions were made by women; a number lost their lives. When the Wright brothers were working on the first airplane, "lady parachute jumpers" were an attraction at the fairs.

Elfride Riolte, pioneer military aeronaut of her sex, was the only woman member of the German Aeronautical Corps during the World War. She became a Zeppelin pilot, braving the dangers of the wartime dirigibles, mainly in test flying.

There were a few women pilots of airplanes in 1914, when the war began. Most of them volunteered. Only two, both Russian, were given opportunity to distinguish themselves. In the first year Marie Kurpyeva won the Cross of St. George and was cited for "daring and successful reconnaissance." Luba Galanschikoff, a volunteer with General Ivanoff's forces, flew with medical supplies from Vilna to the front. She had been an aviator since 1911, and was a skilled test pilot.

After the war she came to the United States as Luba Philipps—she had married a Russian named Philipoff—and demonstrated her talents as a test pilot and exhibition flyer. She was one of the first women aviators to fly a trimotored plane with passengers. An unofficial passenger-carrying altitude record for a woman pilot was claimed for her when she piloted a cabin-load of ten passengers in a trimotored Fokker to 11,000 feet.

RUTH LAW TREHAWKE DAVIS ADRIENNE BOLLAND

Valkyries

By John Goldstrom

HERTA JUNKERS

Although remarkable flying performances have been achieved by women aviators, they have so far quite frankly limited their objectives. Where strength and endurance have been prime requisites, such as in transoceanic and other long nonstop flights, they have engaged pilots of the physically stronger sex to assume the chief burdens of piloting and navigating.

In aviation women compare with men approximately as they do in sports such as golf and tennis. The best of them are better than the average but do not equal the champions. They are the equals of men in courage and intelligence, but are limited by the physical handicap. What some of them have accomplished despite the handicap has been astonishing, particularly such feats as the trans-African flights of Lady Heath and Lady Bailey.

These were not long nonstop flights, but they demonstrated the ability of competent women pilots to travel cross-country over great stretches of uncivilized territory. The American mail pilot flies about five hundred miles in two hops, as a day's work on the airways. Lady Heath, and Lady Bailey, frequently have flown over greater distances in a day's flying in Europe and Africa. Whether women aviators could do such work on schedule the year round, year after year, as many commercial pilots on both sides of the Atlantic have done for a decade or more, remains to be demonstrated.

Women have made no attempt to compete with men for absolute altitude records. In 1928 Lady Heath held the record (unofficial) for her sex with a flight to 24,300 feet. A number of masculine flyers have flown more than two vertical miles higher than that. Such flying, however, is mainly the province of the professional military pilot, and that has remained a masculine monopoly. Possibly some future historian will record the overtaking of man in his last refuge.

Katharine Wright flew with her brothers in the early days of the airplane, but never became a pilot. Harriet Quimby, of Boston, was the first American woman to receive a pilot's license. Theresa Peltier, in France, was the first European woman to fly, and become a pilot. Only seven American women besides Miss Quimby won licenses before the war: Mathilde Moisant, Blanche Stewart Scott, Bernetta Miller, Ruth Law, Julia Clark, Mrs. Richard Hornsby and Dorothy Pierce. Miss Quimby's was awarded in July of 1911. In the following year she became the first woman to pilot an airplane across the English Channel.

Miss Law, who received her license in 1912, once held the American nonstop flight record, from Chicago to Hornell, New York, where she was forced down before reaching New York City, her objective. Miss Law and Katherine and Marjorie Stinson were among the most daring of the exhibition stunt flyers before the war. The latter are sisters of Eddie Stinson, former holder of the duration record and now an airplane manufacturer. They learned the axiomatic truth propounded by their famous brother, who, when asked to define a good landing, said:

"Any landing that you can walk away from is a good landing."

Miss Quimby's crossing of the English Channel from Dover, two years before the World War, was made at a time when few men had made the flight. In a light low-powered monoplane it was an extremely perilous adventure. Elizabeth H. Gregory, literary collaborator with Miss Quimby, said in the New York Times:

"Afterward Miss Quimby enjoyed relating that Gustave Hamel, an aviator, had proposed to don her costume, make the flight, alight in an uninhabited spot, and thus let her have the glory without the danger. She was annoyed at the start by the apparent attitude of doubt on the part of the spectators, and that made her more determined than ever to succeed. They knew that she had never used the machine before the morning of the flight, and that added to their general skepticism. When she did take off the crowd thought it was only for a test

(Continued on page 100)

By John C. Nulsen

Vice-President and General Manager, Mahoney-Ryan Aircraft Corp.

THE man who has the pocketbook to buy an airplane and hire a pilot is primarily a business man and he is not yet air minded. He still considers it a hazardous means of travelling around the country and he has no wish to risk his life. To him I would put these questions: Could he meet competition successfully were he to discard his telephone or his automobile?

Mankind never yet has abandoned a faster means of transportation or communication, once either has been adopted.

The airplane is at once a mode of transportation and a means of transmitting messages. In the air mail it performs the latter function, while in everyday commercial life more and more it carries busy men from city to city and lengthens their days by shortening their travel time.

Aviation for the individual once proved a rather expensive pastime. Few individuals could have devoted their time and money to its development in the early days. Fortunately for aviation, the war placed this responsibility on the shoulders of the government. When hostilities ceased, to all intents aviation was then dropped as being impracticable for commercial uses.

But it had been given its impetus. And now, a decade after the armistice, we find aviation has arrived as an industry and that business is turning rapidly to the airplane as its newest arm.

Where the individual cannot afford an airplane, the corporation can. To date planes have been sold largely to aviators and operators, people who employ airplanes for the sole purpose of earning livelihoods. These planes—and they constitute fully 85 per cent of those in use today—enter taxi and sight-seeing services and perform similar commercial work.

The next large field open to the airplane is that in which the corporation executive moves. And unfortunately for the executive, I think it makes little difference whether he wishes to ride in airplanes.

He will be forced to accept aviation, or he will step down in favor of the man who will fly.

Take the case of two companies whose enterprises cover a wide territory. Company A purchases a plane for use of its chief executives. They learn soon that they can reach several cities during the same day, hold conferences, decide important problems and at the end of the day retire at home or in a hotel for a night of quiet rest.

No hurrying, no waiting impatiently for a train, no sleeping aboard train or rising during dark hours to embark or disembark for a business engagement.

In the meantime, what are Company B's executives doing? Following the *old* routine, for it is rapidly growing old. They ride the trains, lose sleep, finally cover the same territory at considerably more expense in time and find themselves constantly behind their rivals.

Soon Company B says to its executives, "You must use the airplane or we will find men willing to fly."

Possibly this overstates the case, yet I believe just that situation will force aviation on business whether business wants it or not. And I have not yet heard it suggested that business has turned a deaf ear to the roaring motor and whirring propeller.

Oil companies furnish the best example of the business attitude toward the airplane, yet their use of the airplane today is limited; only an indication of what will come. Standard Oil was the first organization of a strictly commercial type to come into aviation by purchasing a plane for its officers. Initiation of this plane was attended by great publicity. Here at last were men who were not afraid to fly in the performance of their routine executive and administrative tasks.

What happened? Texaco purchased a similar plane and sent her executives through the air on important missions.

"You Must Fly or We will have to find men who are willing to take advantage of this faster means of travel to secure more business and save time."

Time was being saved and time is money; money was being saved and earned through the medium of a $50,000 airplane, for the executive staff could accomplish in one day what they previously had done in three.

Then came Richfield Oil. They bought a plane costing $82,000, the last word in airplane construction and refinements. Use of the Richfield plane is limited to the president of the company and some of their major officials.

But the business of producing and selling oil or automobiles or any other commodity is not confined to conferences. Somebody must get out and actually sell the product. Here then, use of the airplane in business begins to show its real growth. Here it goes out on the frontier of business, carries the salesman to his prospect, the agent to the contracting party.

The Texas Pacific Oil company is pioneering in sending her representatives into the field via air to seek new oil leases, to buy oil and otherwise engage in business for the firm. Here men of lesser importance in the councils of the company—the men who go out and bring in the business that produces a profit for the stockholders—use the airplane economically. Their competitors soon will fly or lose business!

American business tends more and more toward the "chain" idea, which, expressed in more simple form, means branches or factories or sales agencies scattered in wide territories. Manifestly such concerns must be on the move and will turn rapidly to the airplane.

One cannot prescribe for any individual business the size or type airplane it should employ, however. This is a subject for consideration by both the purchasing corporation and the airplane manufacturer.

The aviation industry necessarily wishes to cooperate with purchasers of airplanes by furnishing those planes best suited for a given mission or use. Failure of the product to perform any task, even though that job be too big or complicated for the machine, reacts unfavorably to the manufacturer and in the face of increasing competition within the industry each manufacturer tries to fit his planes to the needs outlined by purchasers.

In considering the purchase of a plane, the executive must think first of the investment he wishes to make. There are now more types of airplanes being manufactured by more factories than there are automobile types and factories. Yet the selection should be fairly easy to make, for special types lend themselves to special work.

Probably the best way for an executive to determine upon the proper outlay would be to consider the airplane from an operator's point of view—how much could an operator under similar conditions earn on the plane?

A large, tri-motor plane, for instance, must be kept in the air with load four hours a day to break even or six hours to show a profit.

If a corporation operates a large airplane relatively empty each day, it will have in the plane an unwarranted investment, on which it suffers unneeded depreciation and interest loss and higher maintenance and operating costs. Such an organization would do well to use a small plane, operate it at near-capacity every day and utilize a second small plane for overflow. The converse also holds true. That organization which has use for the large plane may well employ it.

Use of the airplane in business, in my opinion, will have the same general effect we note in the cases of the telephone and the automobile. The telephone enabled man to talk with many times the number of people in a single day that he previously had been able to contact. The automobile enabled him to go further, faster and more often.

Now the airplane provides a new means of increasing the amount of man's energy which he may harness to industry and thus create more of the world's goods, to sell to more people, to increase revenues, to show greater profits to—enlarge the economic circle. Possibly no more human energy will be burned because of the advent of the airplane and the greater possibilities it offers, but it provides a greater outlet for unused and untapped energy. More energy will be

transmitted from human to human through use of the airplane.

I fear I may have given a false suggestion concerning the expenditure or burning up of human energy because of this new and speedy means of travel. The contrary would be true were we speaking merely of "air travel." Those whom I know, without exception (and I include only those who have lost their fear of "going up") think an hour's flight in an airplane is more restful to the nervous system than a ride of equal duration in any vehicle of ground travel. A person who can forget the fear of being dumped on the ground, and there is no reason for any one to have such fear, will find relaxation aplenty in the air.

Insofar as the possibility of accident is concerned, I choose the airplane every time.

There are no crossroads in the sky whence one may meet a speeding, skidding automobile. Up there you do not come suddenly upon another plane darting out from a blind alley.

Clouds? Yes, there are clouds. And clouds sometimes constitute hazards. But trustworthy pilots licensed by the department of commerce as commercial transport pilots do not take chances with their loads.

A glance at statistics in this connection may be of interest. During the year ending June 30, there were 160 fatal crashes in the United States. Of these, only 17 were cases wherein licensed pilots were flying the ships. In the same period, automobiles took a death toll of 150 in San Francisco alone. You are safer in the air, per mile or per hour or per unit of transportation, than on the ground.

The Boeing air mail line flew in excess of 2,400,000 miles last year with not one accident bringing injury to a pilot or passenger. On our own flying field at San Diego our planes in seven years have carried up 28,000 passengers and flown 900,000 passenger miles—without an accident! The record is equalled or surpassed elsewhere.

In consideration of these facts, how rapidly do you think the business executive will adopt the airplane as regular transport equipment in his work?

This cannot be simply answered one year or two. The answer depends to a degree upon the nature of the individual corporation's business. Those companies with holdings over widely scattered territory manifestly will come to use the airplane ahead of those with fairly concentrated holdings. The type plane each will use, as I have pointed out, will depend largely upon the average load or number of passengers the plane will be expected to carry.

As soon as executives and the public in general begin to realize the very low percentage of accidents which occur in licensed planes flown by licensed pilots over recognized air routes, executives will open wide their eyes, recognize the vast possibilities of aviation, and come without mental reservation into the use of airplanes. It is the bold and frequently foolhardy amateur operating in bad weather conditions over territory which has not been surveyed or laid out for airplane use who is causing most of the accidents and filling the papers with black headlines.

I believe a relatively small single-motored cabin airplane will find favor for most business organization uses. Frequently, and usually I believe, only a small group of men will be making business trips. They use the airplane at present for speed, not for quantity transportation. It provides an opportunity to "get there" in time of trouble.

Suppose the general manager of a large concern with headquarters in St. Louis learned of a branch plant being threatened by fire. He could step into a plane within an hour and reach the scene of the conflagration anywhere within a radius of five or six hundred miles during the same day. If it happened that the early train had left, he would be delayed at least a half-day and possibly longer. For "trouble shooting," then, the airplane has its uses.

The airplane industry is pleased to consider itself an "established business." I think it is run on as sound business principles and is showing as high a percentage of profits, considering its age and the experience of its leaders, as any other business. When you find such organizations as General Motors taking it up and going into it with their resources, the question of its assured success is answered.

Prior to the war we found aviation in its experimental stage. War brought forth a crying need for aviation. Airplanes became mobile eyes for the army. Military needs brought about perfection of the airplane much more rapidly than private initiative could have done, because the emergency provided vast sums for the purpose. Strangely enough, we failed to link up the military flying machine with commercial flying.

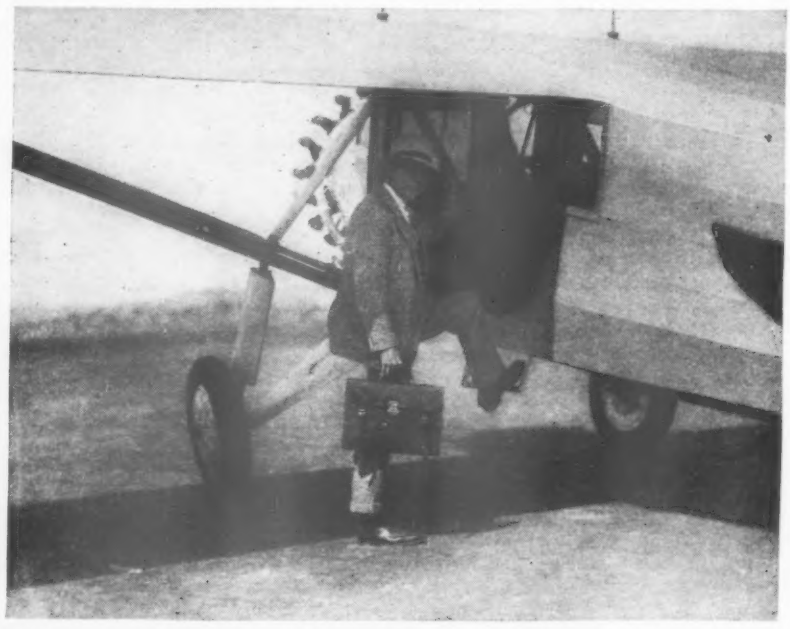
We did not have vision.

Then Colonel Lindbergh flew across the Atlantic. Sensational? Yes. Stunt? No. His flight was scientifically conceived and carried out.

What did it prove?

That the airplane is airworthy, that it will stand up structurally under severe treatment; that our airplane motors will perform many hours and under adverse conditions without faltering. Other pilots in other long-distance flights have added weight to the conclusions drawn from the Lindbergh flight.

Even with good machines and good motors the aviation industry cannot serve business to its fullest efficiency until we standardize production. As in the case of radio, aviation will continue to change and progress rapidly.



Our airplanes are hand built. Can this be economical? The human hand cannot do a given piece of mechanical work more accurately than a machine. Yet with the frequent changes, it is now cheaper to build by hand than to install machinery for machine construction. Manifestly, as is the case with automobiles, final as-

(Continued on page 87)

When QUALITY casts its shadow . . .

Behind every American Eagle airplane is American Eagle's brilliant record for structural stability, unfaltering performance, and faithful service. That's why the American Eagle has become more popular than any other plane in its class. Its reputation for *sheer quality* has spread across the world!

Because of this the American Eagle is a *salable product.* That fact alone makes the American Eagle franchise the most valuable sales contract in the industry today. But this franchise offers many other advantages, as well. A liberal scale of discounts. Immediate delivery of orders. A complete line of models—including a plane for every purse and purpose. And most important of all: the cooperation of a well-known and powerful concern—the first in the industry to maintain a road organization constantly at the service of its sales agencies.

It is true that the American Eagle franchise is eagerly sought for. But it is also true that certain desirable territories are still being held open. We invite you to write to us.

American Eagle planes are powered with motors from 40 to 225 h. p., and are priced from $1,895 to $18,895. Illustration shows the new Kinner powered biplane ($4,595) manufactured under approved Type Certificate No. 124.

American Eagle 49 Brougham, the 4-place cabin monoplane.

American Eagle 69 Sedan, the two-motored cabin monoplane.

American Eagle 29 Flyabout, the 2-place sport biplane with folding wings.

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Large Scale Operations of Five-Passenger Airplanes

By Archibald Black[1] and George F. Wheeler[2]

This is the first of a series of three articles prepared especially for Aeronautics by Archibald Black and George F. Wheeler of Black & Bigelow, Inc. The other two articles, to be published shortly, will deal with large scale operations of ten and eighteen passenger planes, respectively.

The Question of Cost

TEN years ago people questioned the future of air transport on the grounds of safety. No great volume of traffic, they reasoned, could be attracted to a vehicle so dangerous as their mental conception of the airplane. Much has happened since the days following the War and aviation has become accepted readily in quarters where, a decade ago, the pilot or passenger was regarded as a hare-brained individual willing to risk anything for a new sensation. This changed attitude has been variously credited to the Kelly Bill and the Air Mail, the gypsy flyers, Henry Ford's debut in aviation, the work of the Department of Commerce, and the flight of Charles A. Lindbergh. Discussion is futile. All of these did their part and a hundred lesser influences might be added without completing the picture. The fact stands out before us that the public is sold on aviation. Sold—lock, stock and barrel—and up to the point where it will buy anything having the remotest connection with aviation. Only one barrier lies in the course of progress: *Flying is still expensive.*

An Unusual Investigation

It was with this thought in mind that the Editor of AERONAUTICS commissioned the firm of Black & Bigelow, Inc., to undertake a most interesting and unusual investigation—analyses of the cost of airplane operation on a large scale. Here, it seems, lies the solution of the cost problem. For it is axiomatic in transportation that the unit cost drops violently as the scale of operations increases. Hence the Editor asked us to compile a series of estimates looking forward a few years into the future, to the time when airplanes are operating in great fleets instead of making five or six trips a week. Starting with today's scale of operations, flying one small 5-passenger 300-horsepower airplane each way daily, we have projected our estimates far enough into the future to see what happens when the traffic grows. Gradually building up traffic volume by increasing the trips, we carried the estimated operations up to 8 round trips daily. Parallel estimates were compiled for 10-passenger and for 18-passenger ships. There is nothing visionary about these studies. Such types of airplanes as considered are in existence today even in the case of the largest size. All costs are based upon what we have learned from their operation in the past and the entire reduction in possible passenger rates may be credited to the natural savings from increased volume.

Actually, we know these figures are high and we know they will be reduced by the time air line operators attain such volume as 144 passengers each way daily. After all, this volume is puny in comparison with motor bus, rail or steamship traffic and air line traffic won't stop at 144 passengers daily. That's only scratching the surface. We know it just as well as the reader, but engineers must be conservative. So we have kept our estimates within the range of present experience as to size of ships and flying conditions. Even with this conservatism the results are startling. And they're all the more startling when it is considered that operators can reduce them much further. For example, volume production will bring down the cost of airplanes and volume operation will let the operator get more mileage out of ships before they become obsolete. Factors such as these we simply ignored because no one can estimate these savings in the engineering office at this stage in aviation. They are in the laps of the gods. Only the future can tell how much further flying cost can be cut. One thing we know is sure: the cost of operation will be less than our figures for the large scale operations.

The Future of Passenger Traffic

This is extremely interesting, for it shows that air transport will not be confined to mail. It is going to enter the passenger field and is destined to carry a volume of traffic beyond the wildest imagination of the present day operator. In one sense, it will compete with the railroad. It will attract long distance passenger and mail traffic. But it will leave the short hauls of all kinds largely untouched and the heavy freight carriers will never feel its competition. The natural growth of all traffic is sufficient to provide a large margin for diversion to aviation without retarding the growth of railroads. There will be a change in the kind of traffic and there will be some isolated cases where the railroad is affected. But these are special cases and the railroad with energetic management has little or nothing to fear from aviation. After all, the railroads

[1] President, Black & Bigelow, Inc., Air Transport Engineer, and author of "Transport Aviation," "Civil Airports and Airways," etc.
[2] Industrial Investigations Division, Black & Bigelow, Inc.

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are interested in selling transportation. What difference if they themselves take aviation into the fold and sell air transport also? This happened with steamships and with motor busses and it's pretty sure to follow with aviation.

Selecting a Route for Study

However, this is digressing. To get back to our estimates, these are made for an operation between New York and Cleveland without any intermediate stop. This route is by no means an ideal one to fly over, but it has tremendous business possibilities. A great volume of potential traffic exists and the circuitous course of the railroads greatly extends the running time and, on a mileage basis, increases the fare. Hence, the air transport route has the advantage of a shorter course which further decreases the flying time and lessens the advantage of the railroad from the viewpoint of fare. Future development of aerial passenger transportation is dependent greatly upon the possibility of establishing fares close to those charged by railroads, steamships and motor bus lines. It is essential that the present high fares be reduced if passenger transportation is to be developed upon a large scale. The New York-Cleveland route was selected for this study because it offered, perhaps, one of the best opportunities of competing with the railroad without extending the scale of operations too far beyond the present basis of flying in the United States.

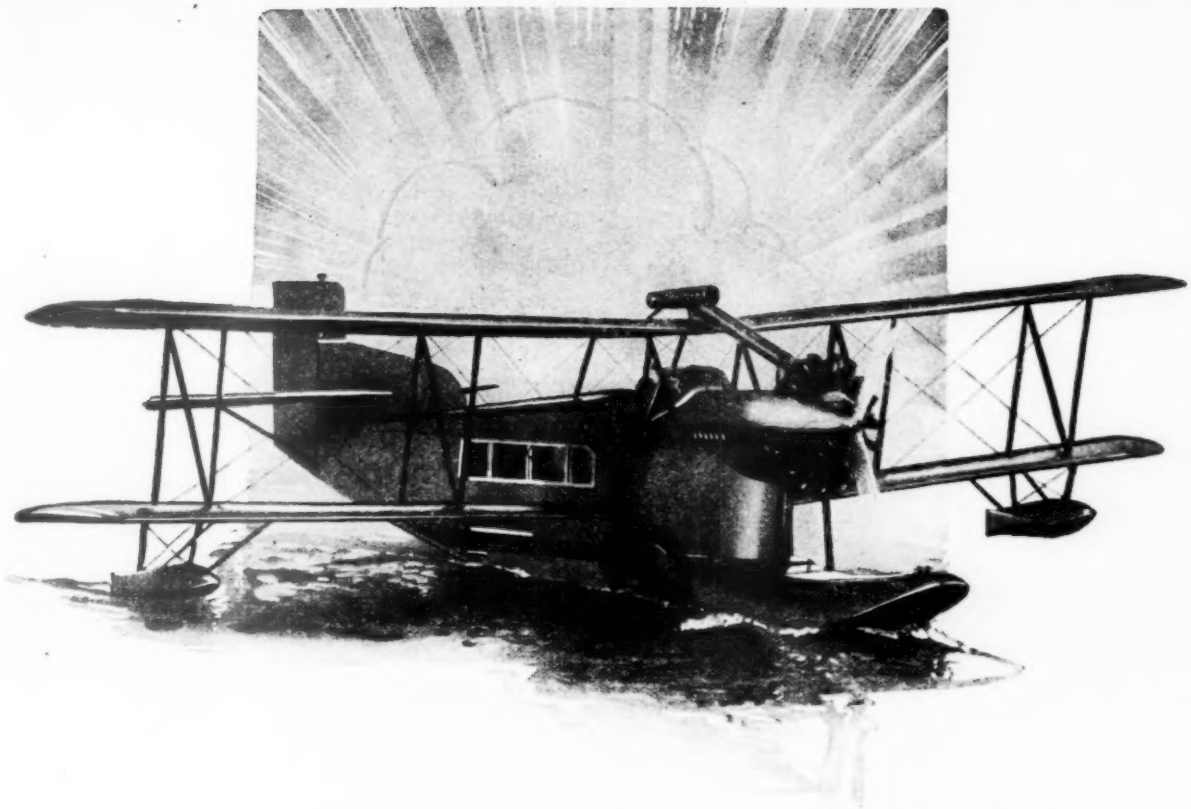
All of these estimates are what might be called preliminary—that is, they were made without an actual survey of the ground and landing facilities and without aerial surveys of the territory to be flown over. However, the route to be flown is well known and one possible course now being used by the transcontinental air mail operators is lighted, equipped with emergency landing facilities, and has been in operation for several years. Consequently, the flying conditions along this route are more or less generally well known in aviation and while far from being ideal from the flying angle present no problems which cannot be met in day to day operation. These qualifications do not in the slightest affect the value of the estimates for the purpose of this study. As a matter of fact, the absence of a ground survey and the necessity of assuming charges for use of flying fields, etc., made it desirable to have all figures tend towards the liberal side. Consequently, many of the items included could be appreciably reduced in actual practice, even at the start. In the larger scale operations, these items could be considerably reduced, but as the study was made for the purpose of indicating the trend of future fares it was neither essential nor desirable that any time be spent on trying to predict the future cost of airplanes, gasoline, engines or other important components of expense.

Three Series of Estimates

The twelve independent estimates have been grouped into three conditions: the first provides for the use of single-engined airplanes with a capacity of 5 passengers and beginning with an operation of one round trip per day. This operation was carried upwards by steps to a total of 8 round trips per day. It was assumed that the route would be scheduled for operation 365 days per year, while the actual flying due to in-

TABLE 1—CAPITAL INVESTMENT

Equipment:				
Round Trips Per Day:	1	2	4	8
Cabin monoplanes, complete with cabin heater and 300 HP engine with starter at $15,000 list price	$ 60,000	$ 99,750	$148,500	$229,500
Spare 300 H. P. engines at $4,800, list price	9,600	19,200	27,360	43,200
Set spare wings complete with tanks, flaps, ailerons, struts, etc. (crated)	4,500	5,000	6,000	10,000
Spare undercarriage (crated) less wheels	1,060	2,120	2,120	2,120
Set spare wheels with brakes, tires, etc. (crated)	400	800	800	800
Set spare tail surfaces complete	796	1,592	1,592	1,592
Set navigation lights, landing lights, parachute flares with brackets, storage battery and other special airplane equipment	2,181	3,829	6,017	9,846
Trucks: 1½ ton panel body, delivered	750	1,500	1,500	2,250
Miscellaneous spare parts supplies, about	2,000	2,500	3,000	4,000
Miscellaneous crating and shipping cost, about	500	1,000	1,500	2,000
Shop and office equipment (flying fields), about	3,500	5,000	6,000	7,500
Executive and Traffic office equipment, about	2,000	2,500	3,500	6,000
Total Equipment Costs	$ 87,287	$144,791	$207,889	$318,808
Organization and Introductory Costs:				
Round Trips Per Day:	1	2	4	8
Incidental legal and other organization expense	$ 1,000	$ 1,000	$ 1,500	$ 2,000
Engineering services on traffic surveys, selection of route operating bases, planning of operations, etc., about	3,500	4,500	6,000	10,000
Six round trips over route for demonstration purposes, 4,740 miles	3,527	3,000	2,526	1,953
Introductory, advertising, publicity, etc., about	3,500	4,000	6,000	7,500
Miscellaneous small expenses, about	1,500	3,000	5,000	8,000
Total Introductory Costs	$ 13,027	$ 15,500	$ 21,026	$ 29,453
Total Equipment Costs	87,287	144,791	207,889	318,808
Total Investment (excluding Working Capital)	$100,314	$160,291	$228,915	$348,261
Working Capital				
The amount allowed under this head will depend greatly upon what the traffic prospects are. However, for the purpose of these estimates it is considered that the traffic possibilities are excellent. In first estimates of this character it seems advisable to allow a sum at least equal to the total of all operating charges for a period of 4 months, or about	64,469	109,746	185,153	319,056
Total Investment Required	$164,783	$270,037	$414,068	$667,317



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terruptions caused generally by weather would be slightly less. In the ordinary course of events it should be possible to maintain an efficiency of over 90 percent and possibly as high as 95, although only 90 percent was assumed in the calculations. The second condition of operation provides for the use of three-engined cabin airplanes with a capacity of 10 passengers, similarly starting with one round trip per day and increasing by steps to 8 round trips per day. The third series of estimates assumes the use of three-engined airplanes with a pay load capacity of 18 passengers beginning with an operation of one round trip and again increasing by steps to 8 round trips daily.

While a very substantial further decrease would be shown by assuming the use of 30 passenger airplanes and more than 8 round trips daily, these conditions were intentionally left out of consideration as being too far beyond the present scale of airplane operations and because it seemed particularly desirable to consider only sizes of airplanes which were already in successful operation lest the charge of being visionary be raised by those reading this series. In calculating the cost of operating airplanes, it is necessary to begin with a study of the scheduled operations, building up from this the required data for the calculation of costs. This first article of the series will be devoted mainly to the study of condition number 1 in which 5-passenger single-engined airplanes are to be used.

The calculations have been made for 1, 2, 4 and 8 round trips daily, 7 days per week between New York and Cleveland, subject to the question of weather interruption. No intermediate stop is provided for in the schedule, although it is contemplated that emergency landing facilities will be available along the route and that emergency stops may be made occasionally at such places as Bellefonte, Pa. The approximate distance along this route is 395 miles. The scheduled speed of flying has been taken at 100 miles per hour as airplanes are available at present with performance sufficiently beyond this to insure the maintenance of schedule even against adverse winds.

The total scheduled operations per year are as follows:

Number of Round Trips Per Day	Number of Miles Per Day	Number of Miles Per Year	Number of Hours Per Year
1	790	288,350	2,884
2	1,580	576,700	5,767
4	3,160	1,153,400	11,534
8	6,320	2,306,800	23,068

To allow for interruptions of schedule due mainly to poor visibility and other bad weather conditions, it is necessary to deduct between 5 and 10 percent from the schedule set up in the plan of operations. In order that this estimate may err on the conservative side, the maximum deduction of 10 percent has been used, although it should be possible to do better and the regular operation of the air mail routes attains a higher percentage of completed trips than assumed in this estimate. All schedule flying has been assumed to be done during daylight hours, the airplanes leaving New York and Cleveland simultaneously. Occasionally, it might be necessary to land after dark if a trip has been slightly delayed through any cause, but in the regular course of operations, the trips will be completed before sundown. Allowing for the above deduction of 10 percent, the net revenue flying for the various scales of operation become as follows:

Number of Round Trips Per Day	Number of Single Trips Per Year	Number of Seat Trips Per Year	Number of Revenue Miles Per Year	Number of Revenue Hours Per Year
1	657	3,285	259,515	2,595
2	1,314	6,570	519,030	5,190
4	2,628	13,140	1,038,060	10,381
8	5,256	26,280	2,076,120	20,761

The above table provides the basis for estimate of revenue per passenger fare, transport of mail and packages, but an addition must be made to provide for ferrying of airplanes from field to field, test flying, demonstration flights and other miscellaneous flying which is not productive of revenue. Experience has shown that flying of this kind for an operation such as contemplated is generally about 8 to 10 percent of the total mileage. In our estimates we used the higher figure, making the corrected total for total operations as follows:

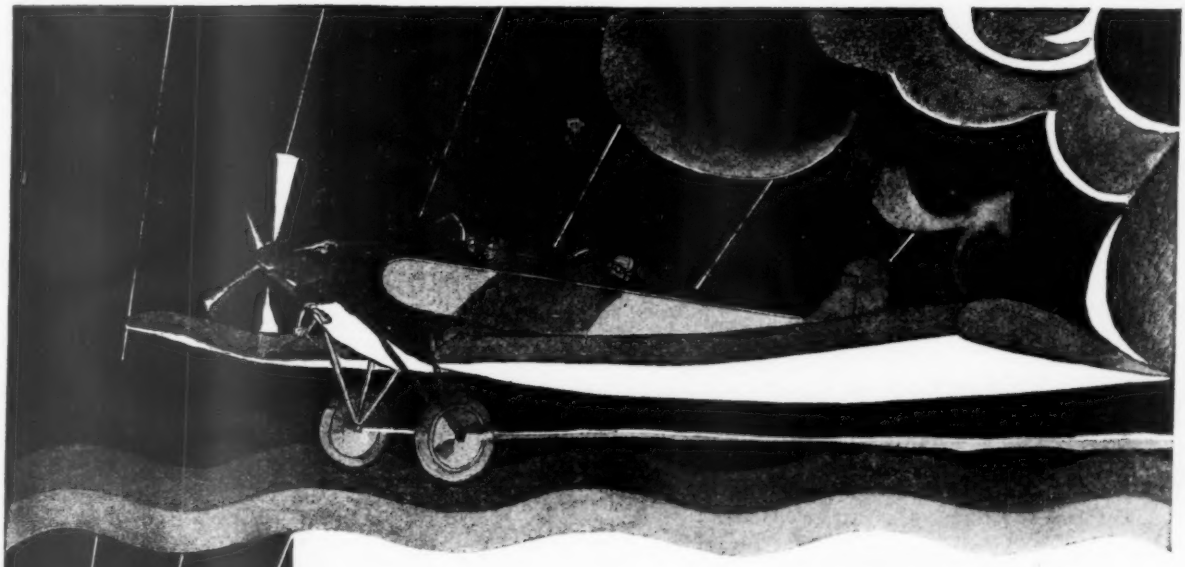
It now becomes necessary to study the question of overhauls for the purpose of providing a basis for determination of maintenance costs. Under conditions of operations such as contemplated, the airplanes should be overhauled after about 1,000 hours in use and the modern engines on the basis of about once for every 250 hours in use. Actually, these figures could be exceeded without danger, but here again we have chosen to keep the estimates within the limits of present experience. Although 1,000 hours for airplanes and 250 hours for engines may seem a very conservative overhaul basis in a few years from now, it is not desirable at this stage to do any theorizing. The overhauls on these bases are as shown in the table at the head of page 42.

Number of Round Trips Per Day	Revenue Miles Per Year	10% Allowance	Total Mileage Per Year	Total Hours Per Year
1	259,515	25,952	285,467	2,855
2	519,030	51,903	570,933	5,709
4	1,038,060	103,806	1,141,866	11,419
8	2,076,120	207,612	2,283,732	22,837

Assignment of Personnel and Equipment

For the purpose of determining the amount of equipment and the personnel required, it is necessary to make a study of the assignment of each of these. The operating headquarters is assumed to be at the New York end in each case, but it makes no difference from the practical viewpoint whether it is located at New York or Cleveland. If future operations required extension from the Cleveland end, locations at that city would become desirable. In the case of the larger operations, where 4 and 8 trips are made per day, it would become desirable to have a well equipped shop at the Cleveland end also and to figure about one-half of the equipment being based there and overhauled in that shop. Some spare parts and other equipment should be kept at Bellefonte for emergency purposes. In estimates of this kind, it becomes necessary to make quite a detailed study of the assignment of personnel. However, we are not including these detailed figures in this article, excepting where a few appear in the tables to follow where the question of salaries for personnel is considered. The actual assignment of this personnel is considerably affected by the scale of operations, although the executive office, chief traffic office and maintenance base may be assumed to be at one end or the other.

With the foregoing information, we are now in a position to estimate the investment required. In the contemplated operations, it has been assumed that existing airports would be utilized. Hence



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The performance of the NB3 is superior to many planes with three times its power. Ease of handling and low maintenance make the NB3 ideal for student, passenger and transport use. All metal structure assures safety—and unique construction permits economical quantity production to meet a popular demand.

The NB3 is the lowest priced three place ship of any kind equipped with new production, dual ignition engine. No other all metal structured, three place monoplane in the United States sells for less than $10,000—And completely equipped, the NB3 is only $3,600, flyaway Marshall.

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TABLE 2—OPERATING COSTS FOR ONE YEAR

Round Trips Per Day:	1	2	4	8
Fixed Operating Costs				
Rent of hangars and use of fields at New York and Cleveland and intermediate fields	$ 2,000	$ 3,500	$ 5,500	$ 9,000
Rent of executive offices at New York	1,500	2,000	3,000	5,000
Depreciation of airplane equipment and spare parts (less engines)	10,330	16,570	23,500	35,218
Depreciation of motor trucks	250	500	500	750
Depreciation of shop, office and miscellaneous parts and equipment	1,125	1,500	1,875	2,625
Airplane insurance at	15,708	26,458	38,478	59,412
Insurance on ground equipment, workmen's compensation, etc	850	1,950	3,800	7,400
General and Operations Manager	6,000	6,500	7,000	7,500
Assistant General and Operations Manager			4,000	5,000
Engineering, accounting, legal and other professional services	4,000	6,000	8,000	12,000
Base pay of pilots at $2,500 per year	7,500	15,500	35,000	70,000
Chief Mechanics at $3,640 per year	3,640	7,280	7,800	8,400
First Class Mechanics at $3,120 per year	9,360	15,600	24,960	40,560
Second Class Mechanics at $2,600 per year	7,800	13,000	20,800	33,800
Utility Clerks at $1,690 per year	3,380	5,070	6,760	10,140
Bookkeepers at $2,080 per year	2,080	4,160	6,240	8,320
Stenographers at $1,560 per year	1,560	3,120	4,680	6,240
Office supplies, printing, telephone, postage, etc., about	1,000	1,500	2,500	3,500
Sub Total	$ 78,083	$130,208	$204,393	$324,865
Contingencies and Miscellaneous 10%	7,808	13,021	20,439	32,487
Total Fixed Operating Costs	$ 85,891	$143,229	$224,832	$357,352
Variable Operating Costs				
Airplane gasoline, oil and grease	$ 15,703	$ 31,400	$ 62,805	$125,604
Pay on Pilot's mileage	14,273	28,547	57,093	114,187
Depreciation of engines	6,207	12,453	24,411	47,736
Allowance for crash losses not covered by insurance	2,840	5,680	11,360	22,720
Airplane periodic overhauls	5,710	11,420	22,840	45,680
Engine overhauls	5,710	11,420	22,840	45,680
Trucking, express and freight, about	750	1,200	1,500	2,000
Motor transport	1,500	2,000	2,500	3,000
Pilot's travel expenses	2,190	4,380	8,760	17,520
Other travel expense	1,000	1,500	2,500	3,000
Telephone, telegraph, mail, etc., on operations, about	750	1,000	1,500	2,000
Sub Total	$ 56,633	$111,000	$218,109	$429,127
Contingencies and Miscellaneous 10%	5,663	11,100	21,811	42,913
Total Variable Operating Costs	$ 62,296	$122,100	$239,920	$472,040
Traffic Costs				
Rent of ticket office space in New York			$ 1,200	$ 2,000
Rent of ticket office space in Cleveland	$ 900	$ 900	1,000	1,500
Traffic Manager (New York)	5,000	6,000	7,000	7,500
Assistant Traffic Manager (Cleveland)	4,000	4,500	4,500	5,000
Traffic solicitors at $2,750 per year	5,500	8,250	11,000	16,500
Stenographers at $1,560 per year	3,120	3,120	4,680	6,240
Clerks at $1,040 per year	1,040	2,080	2,080	3,120
Printing, mimeographing and other direct mail work on air mail, package and passenger development	4,000	5,000	6,500	7,500
Advertising, magazine, poster and miscellaneous	6,000	10,000	15,000	20,000
Publicity work, New York and Cleveland	2,500	3,000	4,000	5,000
Commissions, about	8,000	14,000	24,000	40,000
Telephone, telegraph and mailing, about	750	850	1,000	1,200
Office supplies, about	300	400	500	600
Sub Total	$ 41,110	$ 58,100	$ 82,460	$116,160
Contingencies and Miscellaneous 10%	4,111	5,810	8,246	11,616
Total Traffic Costs	$ 45,221	$ 63,910	$ 90,706	$127,776
Total Fixed and Variable Operating Costs	148,187	265,329	464,752	829,392
Total Operating Costs Including Traffic Department	$193,408	$329,239	$555,458	$957,168

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no allowance has been made for the cost of buildings, field construction or the purchase of real estate. The investment may thus be divided into expenditures for equipment, organization, introductory cost and working capital, all of which are shown in the accompanying Table 1. These figures are given sufficiently in detail to be quite self explanatory and it seems unnecessary to make very much comment beyond pointing out that the investment does not increase in proportion with the scale of operations. Hence from the very start an important economic advantage is indicated for the large-scale operations.

Number of Round Trips Per Day	Total Hours Per Year	Number of Plane Overhauls Per Year	Number of Engine Overhauls Per Year
1	2,855	2.855	11.42
2	5,709	5.709	22.836
4	11,419	11.419	45.676
8	22,837	22.837	91.348

The next step in compilation of these estimates is the calculation of operating cost. This involves a very considerable amount of rather uninteresting detail and hence only the results are included in this article. These are shown in Table 2 in three major groupings of fixed operating costs, variable operating costs and traffic costs. Fixed operating costs are those operating costs which are not *directly* affected by the amount of flying while the variable operating costs are those incurred only when the ships are in flight. The title "Traffic Costs" is quite explanatory and these represent the cost of developing business. From the totals obtained by these estimates it is now possible to analyze the cost of operation for the purpose of ascertaining the unit cost per trip and per passenger.

The Cost per Passenger Mile

In the final Table 3, these unit costs are given in convenient form for comparison and they present a most illuminating picture. The cost per passenger mile, which is around 15 cents for the small scale operation carrying 10 passengers, drops rapidly until, in the 8-trip operation, carrying 40 passengers each way daily, it is only slightly over 9 cents per passenger. These figures, however, make no allowance for empty seats, an important point which must be considered. On the other hand, no operator is going to make 8 round trips unless he averages nearly a full load. Otherwise he will certainly take one trip off his schedule of service. Hence, this 9 cents per mile rate should be almost, if not entirely, possible of attainment in practice for the 8-trip operation. The purchase of fuel in large quantities and future decreases in flight equipment costs should bring sufficient further reductions to provide a margin for both profits and empty seats. This completes the first study of our series and brings us up to the point where the use of larger airplanes becomes desirable. Hence the next article of this series will consider the operation of 10-passenger types.

TABLE 3—UNIT OPERATING COSTS

Round Trips Per Day:	1	2	4	8
Fixed Operating Cost per Revenue Mile	$ .331	$ .276	$ .217	$ .172
Fixed Operating Cost per Revenue Trip	130.75	109.02	85.72	67.94
Variable Operating Cost per Revenue Mile	.24	.235	.231	.227
Variable Operating Cost per Revenue Trip	94.80	92.83	91.25	89.67
Total Fixed and Variable Operating Cost per Revenue Mile	.571	.511	.448	.399
Total Fixed and Variable Operating Cost per Revenue Trip	225.55	201.85	176.97	157.61
Traffic Cost per Revenue Mile	.174	.123	.087	.061
Traffic Cost per Revenue Trip	68.73	48.59	34.37	24.10
Total Cost (including Traffic Costs) per Revenue Mile	.745	.634	.535	.461
Total Cost (including Traffic Costs) per Revenue Trip	294.38	250.56	211.36	182.11
Traffic Costs Percentage of Total Costs	23.3%	19.4%	16.3%	13%
Traffic Costs per Passenger Mile	$ .149	$ .127	$ .107	$ .092

Monthly Financial Review

By J. Allen Grover

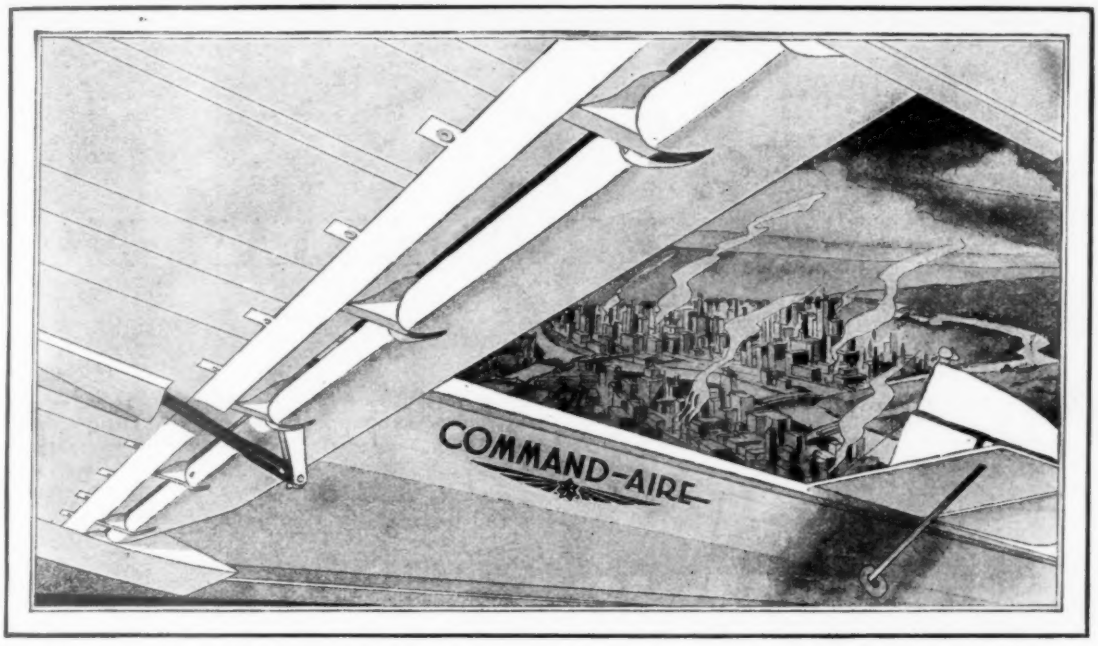
Pynchon & Company, New York City

THE uncertain credit situation, which was the dominant factor in the market when this column was last written, finally precipitated a break in security prices on March 26th, the severity of which was none the less disturbing because it was expected. Enormous declines were registered in values during the trading which exceeded in volume all previous records on the New York Stock Exchange. Call money loaned at 20% and panicky traders fought to sell their holdings on the decline.

When the downward rush stopped, a recovery almost as violent as the break set in and within 48 hours averages had gained back a good part of their losses.

After a week, it did not seem, on paper at least, that there was much difference in the market, but looking deeper, two vital facts emerged. One was that the Federal Reserve Board still held the credit situation under control and was determined to force further liquidation. The other was that the public had taken its medicine bravely, but had found it distasteful and was for the moment out of the market. As the result, there have been a series of quiet sessions with the trading falling under 3,000,000 shares on the New York Stock Exchange and prices declining slowly and in an orderly fashion.

Aviation stocks followed the general market, but except in the case of a few which owed their support to pool opera-



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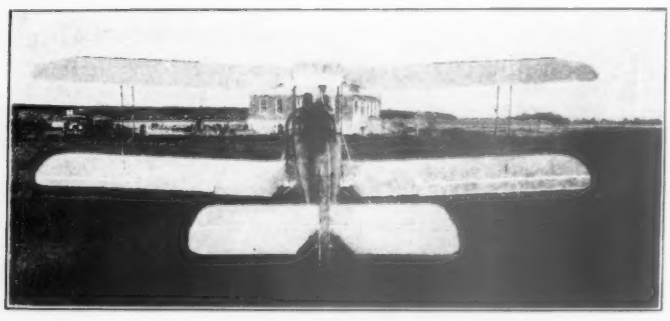

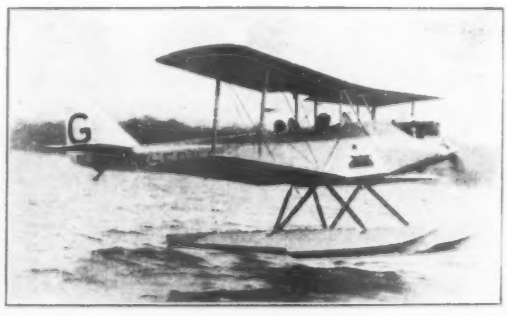

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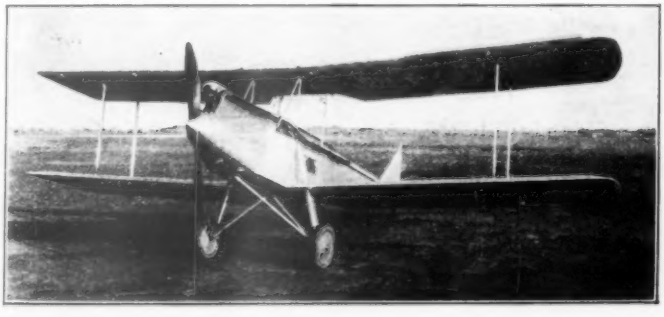

T R A I N I N G P L A N E O F T H E W O R L D

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tions, they behaved remarkably well as a class, particularly in view of their unseasoned character. Indications are that the continued firmness of money and the threatened investigation of the Reserve Board by Congress at its special session will retard any general upward movement in the market for a time and meanwhile the aviation industry will have its first opportunity to gauge the loyalty of its financial supporters.

Have the purchasers of aviation securities bought their stocks with a proper understanding of the long road the industry must travel to reach stability, or have they rushed in because money was plentiful, in the hope of quick returns from principal appreciation? The present market may offer an opportunity for these vital questions to be answered and the sooner the industry shakes out the purely speculative interest the healthier it will be.

The quotations below give the high for 1929 and the current (April 19th) price of aviation stocks on the New York Stock Exchange and the New York Curb Market. The closing prices on March 19th are also given this month to provide comparison between present prices and those before the break in the market on March 26th.

	High 1929	Closing Mar. 19, 1929	Current April 19, 1929
*Curtiss Aeroplane & Motor Co.	173½	154	148⅝
*United Aircraft & Transport Pfd.	80	69½	77⅞
*United Aircraft & Transport	97⅜	84⅞	102¾
*Wright Aeronautical Corp.	299	273	247
**Aero Supply Mfg. Co. A	44½	44	43
**Aero Supply Mfg. Co. Rights	5½	....	5
**Aero Supply Mfg. Co. B	43½	42½	43
**Aero Underwriters Corp.	48½	44¼	38⅛
**Alexander Industries	23	20¾	16¼
**Aviation Corporation of the Americas	89⅞	61½	66¾
**Aviation Corporation	22⅞	21¼	20
**Aviation Credit Corp.	23⅝	21⅞	18½
**Bellanca Aircraft Corp. of America	23¾	19½	18½
**E. W. Bliss Co.	57⅞	50	42⅜
**Consolidated Aircraft Corp.	43	36⅝	31
**Consolidated Instrument Company	35	....	27½
**Curtiss Aero Export	52⅞	44	42
**Curtiss Flying Service, Inc.	25	22	24⅛
**Curtiss Reid Aircraft, Ltd., Pfd.	35	....	29
**Douglas Aircraft Co., Inc.	33⅞	32¾	30¾
**Fairchild Aviation Corp.	34⅞	27½	22
**Fokker Aircraft Corp. of America	44⅜	37	35¾
**Irving Air Chute Co.	29	26¾	24
**Keystone Aircraft Corp.	50	40¼	38
**National Aviation	76	83⅞	71¼
**North American Aviation	19	16	16⅛
**Sikorsky Aviation Corp.	63⅞	49⅞	51
**Transcontinental Air Transport	30¾	28	26½
**Travelair	61	53½	45⅛
**Universal Aviation	27¾	21¼	18¼
**Western Air Express Corp.	58⅞	....	58⅞

*New York Stock Exchange. **New York Curb Market.

New Companies

On April the 15th, Woods, Faulkner & Company of Chicago offered 45,000 shares of no par New Common Stock of the Arrow Aircraft & Motors Corporation, at $12.50 a share. The company has an authorized capitalization of 100,000 shares with no funded debt and no Preferred Stock. This company will manufacture a small two-place sport plane which has been developed at considerable expense and for which the company reports orders of 223 ships.

Elias Aircraft & Manufacturing Corporation—Lowell Underwriters, Inc., of 551 Fifth Avenue, New York, have offered 30,000 shares of the no par Common Stock of this company at $25 a share. Capitalization of the company consists of 2,000 shares of $100 par 6% Preferred Stock authorized and outstanding; and of the 100,000 no par Common Stock authorized, 80,000 shares will be outstanding after this financing is accomplished. This company is the outgrowth of the privately owned lumber and mill business which during the last few years has become interested in aeronautics. The company will manufacture an airplane in various designs, purported to appeal to the commercial trade as well as the Army and Navy flying services.

Inter-American Air Transport, Inc.—This company has been formed to acquire the assets of the Tri Motor Safety Airways, holders of the New York-Buenos Aires government air mail contracts. Public financing has been held in abeyance for the moment. The fact that Mr. R. H. Fleet, President of the Consolidated Aircraft Corporation, will be president of the new concern also indicates a close working agreement between the two, especially in view of the fact that Inter-American Company is reported to be the concern which ordered six Commodore flying boats from the Consolidated Company at a reputed price of $150,000 per ship.

O'Brian, Potter & Stafford of New York have offered 100,000 shares of no par Common Stock of the Stout-D & C Air Lines, Inc., at $12.50 per share. This company has an authorized capitalization of 300,000 shares, 100,000 of which will be outstanding. The company has been formed to finance a transportation service between Detroit and Buffalo and as its name implies has the Detroit & Cleveland Navigation Company behind it as well as the Stout Company. The stock carries warrants entitling holders to buy an additional share of Common at $12.50 per share until April 2, 1932, in the ratio of one share for each share held.

Reports from the Pacific Coast advise that another finance company has been formed with a capitalization of $30,000,000, to be known as the "Aircraft Finance Corporation." The Hunsaker interests are at the head of this new venture which apparently intends to operate as the large acceptance corporations do in the automotive industry. No financing has as yet been offered.

National Flying Schools, Inc.—This company has been organized by Buffalo interests and privately financed for the purpose of establishing a chain of flying schools throughout the country. Its officers are largely Buffalo men, headed by Mr. R. H. Fleet, President of the Consolidated Aircraft Corporation.

Aircraft & Airways of America, Inc.—This company has been formed to take over Bettis Field at Pittsburgh and in addition to operating the field will establish there a flying school. No financing has been announced for the time being, but it is understood that the Keyes interests have assumed control.

The Bendix Aviation Corporation—This company has been formed as a consolidation of the following companies to engage in the manufacture of aeronautical accessories: Bendix Brake Company, Eclipse Machine Company, Delco-Remy Corporation, Stromberg Carburetor Company and Scintilla Magneto, Inc.

General Motors will own a 25% minority stock interest in this company, which is expected to develop into one of the biggest things of its character in the country. The financing is being done through an exchange of stock of the various units for stock of the parent company and no public financing is planned. Owing to the presence on the new Board of several men connected with the Wright Aeronautical Corporation, the Curtiss Aeroplane & Motor Company and the Aviation Corporation, it is assumed that these major aviation interests also have some position in the new company, although the actual percentage of stock ownership which they or their officers will hold is not known.

Numerous other companies have been formed during the month, but their capitalization is either very small or their stock so closely held that they could not be of great interest at the moment to the general public.

Mergers and Consolidations

The Aviation Corporation, the formation of which was reported in this column last month, has proved the center of merger rumors for the last few weeks. The definite accomplishments of this company in its less than two months of existence are as follows:

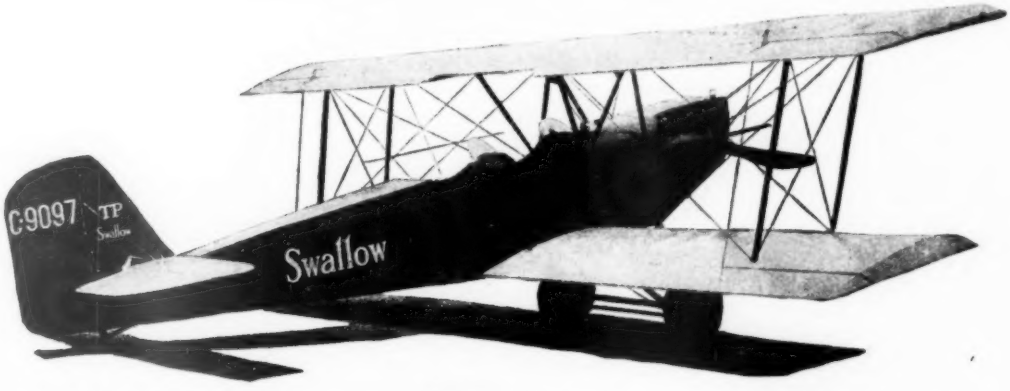
The company has offered to exchange its stock on a share for share basis for the stock of the Universal Aviation Corporation, the offer being contingent upon the Aviation Corporation gaining control of at least 51% of Universal stock by May the 20th. Enough large shareholders of Universal have signified their intention of accepting the offer to make the acquisition of the Universal Company a practical certainty. The Aviation Corporation has also been appointed Manager of Roosevelt Field, Inc., for which it will receive a management fee, and the Aviation Corporation has also announced that it has purchased 60,000 shares of the Common Stock of Roosevelt Field, Inc. An offer has also been made by Aviation Corporation to exchange 210,000 of its Common shares for 150,000 shares of the Fairchild Aviation Corporation, or in the ratio of one and two-fifth shares of Aviation Corporation stock for each share of Fairchild. Should this offer go through, it will also include the Kreider-Reisner Company which is to be acquired by Fairchild. In conjunction with Air Investors, Inc., the Aviation Corporation has also acquired control of the Embry Riddle Company, which operates an air mail and passenger service between Chicago and Cincinnati via Indianapolis and which line will of course be an important connecting link between the Universal Company's Chicago service and their Cincinnati-Cleveland line.

The Aviation Corporation has also offered to exchange its stock for the Colonial Airways, Inc., operators of passenger and airmail planes between New York and Boston, and Boston and Cleveland via Albany. The stock of this company has been very closely held and it has not been revealed what the exchange offer was. These various developments place the Aviation Corporation in a position comparable in variety of interest to the United Aircraft & Transport Company and the more loosely knit together group of companies, commonly known as the Curtiss-Keyes interests, and the still less coordinated Hoyt interests. The matter of actual cohesion of the various units of the Aviation Corporation is not so vitally important as the fact that behind all of the component parts stands a representative interest with adequate resources to develop the various companies as rapidly as matured judgment shows they should be developed.

Another interesting combination within the last month has been the purchase by the United Aircraft & Transport Company of 50,000 shares of stock of the Aviation Corporation of the Americas. Just where this stock was obtained or the price paid for it is not known, but it is known that the United Company has now abandoned its idea of inaugurating independent air lines in Mexico and Central America and instead will cooperate closely with the Aviation Corporation of the Americas who have a great advantage so far over any competitors in this field.

The trend in the United States toward consolidations and mergers has had its effect on Canadian aviation interests which have recently announced a merger of three of the largest commercial aviation concerns in the Dominion. The companies affected are Fairchild Avia-

(Continued on page 84)



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CURRENT COMMENT

Harley W. Mitchell

AN open attempt is being made, apparently, to corral everything, motors, planes, accessories, landing fields, schools, transport lines and even publications, into one gigantic aeronautical trust under banking control.

This means but one thing—the annihilation of competition, the stifling of aeronautical development for the personal aggrandizement of a few men.

An industry which, by its very potentialities, may well be a dominating power in the world, may find itself under the thumb of a few gentlemen from Wall Street.

The Trust

Honest mergers for the purpose of greater efficiency are not only justified, but render the public an increased service, but the deadly type of concentration for the sake of complete dominance is menacing.

Astute financial observers are beginning to look askance at certain types of consolidations. The briefest study of balance sheets and earnings statements brings out the fact that there is no hope, in many cases, of even a normal interest return on the stock offered to the public.

We believe this is a dangerous situation; that it is contrary to public policy and warrants proper investigation.

Aviation needs a period of free competition for its own good. Design and construction have not become standardized or fixed. New ideas are coming to the fore and a complete control of industry by a selfish group or groups will likely have a deterrent effect on progress.

The country has many business units engaged in various aeronautical activities, captained by splendid men of vision and capacity. We would hate to see these units absorbed and these leaders made subordinate cogs in a huge financial machine. Aviation needs them in their present places, free to progress and develop.

There is a larger danger in all this; a danger that attends most such financial consolidations. Capital always seeks and obtains political power. Aeronautics needs and must have some form of governmental control because of its very nature. The passing of this control into the hands of a politically minded financial group could do more than stifle competition and throttle development.

It could dictate to the student where he should go to school. Other schools might have difficulty in securing licenses and ratings, and students might never pass their license examinations.

It could dictate to the pilot what make of machine he should fly and with what motive power. Other makes might fail to receive certificates, no matter how worthy.

He might be compelled to operate only in certain specified territory. Landings in other fields might be fraught with expensive consequences.

This is not a far fetched vision of what could happen. It is an indication of what a powerful trust could do in this one industry. Any attempt to control aeronautical affairs for the purpose of complete dominance should be fought by all those who realize what such control might mean.

Aeronautics intends to keep the public fully informed on developments of this type, and will welcome correspondence on the subject.

IF someone had suggested to George Washington that he should seek out the comparatively useless gentleman who ran the Navy, and gently seek his permission before crossing the historic Delaware, George, who had good sense, would have gazed rather sorrowfully at him and locked him up where he would be safe.

The good general believed somewhat as the illustrious Bonaparte, that battles are fought on the field of battle. He undoubtedly felt that he knew more about his kind of fighting than anyone else within calling range, and he meant to fight it out first and seek advice later.

Politics and National Defense

The mad and unbelievably selfish attitude of our civilian and military politicians, who cavalierly subordinate the good of the country to their stubbornness and private ambitions, is one of the most curious developments of this era. They justify their attitude with the most idiotic drivel sane men ever gave voice to. They seek by inertia to stultify any forward move which might take an ounce of power out of their hands.

A fleet of enemy machines shot out to knock New York into the Paleozoic age again will not stop to refer the matter to our land, naval or armchair forces. Our air force will find itself with two commanders-in-chief, neither one of whom knows as much about the needs and tactics of the air as a half-dozen of his muzzled subordinates.

The forces of the air *are neither a toy nor an accessory* and it is about time the public conscience became aware of the fact. The forces of the air *are our most important line of defense* and time will prove this. The air responds to commanding intelligence, and is as dangerous as a bat out of Hell when it tries to use sweet words and ego as a substitute.

Congress should be aware that neither a politician

(Continued on page 106)

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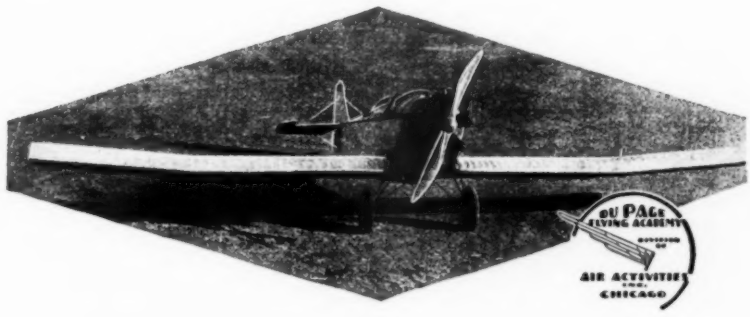

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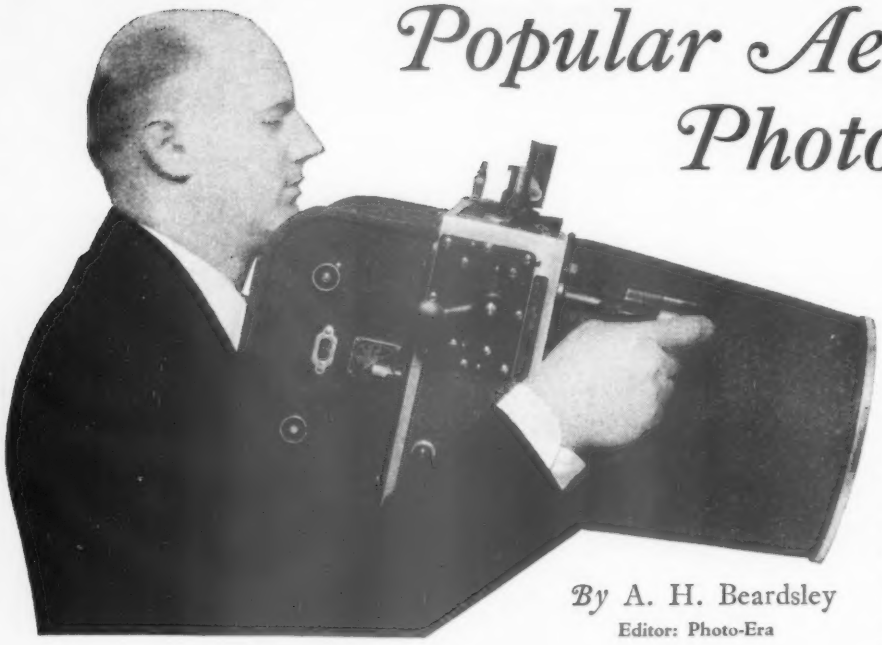
Popular Aerial Photography

Part II



By A. H. Beardsley
Editor: Photo-Era

IN the preceding article on this subject I pointed out that amateur aerial photography was coming, just as surely as amateur movies have come and have proved practical and successful. I predict that photographic manufacturers will soon feel an insistent demand for an amateur aerial camera which will meet the needs of the vacationist, tourist, traveler and average business man. Such a camera will have to be comparatively reasonable in price, simple to manipulate and yet be capable of making a clear picture.

I would not say, at this time, that such amateur cameras will be able to equal the superb results which are now to be obtained with the specially designed and expensive cameras used by the U. S. Army and the U. S. Navy, Government Departments and professional aerial photographers.

However, I do believe that an amateur aerial camera will be devised which will make pictures that will be satisfactory to the class of users for which they will be intended. For those who have the means, there are now a number of aerial cameras of American and European manufacture which are marvelous instruments of precision, yet not beyond the mastery of the experienced amateur photographer.

There seems to be a reversal of procedure in the case of aerial photography. By that I mean that the more expensive and efficient equipments have become available before those of more moderate cost have even been considered. In the case of still photography the manufacture of the more simple and less expensive cameras preceded the development of the so-called de luxe outfits. The fact that modern aerial photography was born during the World War may have something to do with this peculiar development. In those stirring days, money was no object, provided an aerial camera could be devised which would produce the needed pictures of enemy lines.

To-day it seems as though there was no stopping the "air mindedness" of the public. The automobile revolutionized the thought and the lives of thousands and the airplane is doing the same thing. The motor car widened the field of photography and probably millions of cameras have been sold in all parts of the world as a result of this great broadening of photographic opportunities.

A New World

Now comes the airplane which opens another new and wonderful world to the professional and amateur photographer. Is it not reasonable to assume that thousands will wish to photograph the beauties and wonders of the world as seen from the air?

But my readers may say, "This is all very well; but what we would like to know is whether we can get any pictures with the cameras we now have, if we take them up in a plane?"

Yes, and no! If I were to say yes, many of my readers would try it, get poor or no results at all, and then assert that I did not know what I was writing about. If I were to say no, many of my readers would take their cameras aloft and make very creditable pictures, thus proving again that I did not know what I was writing about. From my own experience I say, "yes and no."

Why? Because all amateur cameras are not adapted to use in the air. In fact, some will say that no amateur camera is suited to meet aerial conditions; but I have used my own cameras in the air and have results to prove my point. I will admit frankly that, so far, I have not been able to equal the work of the regular aerial cameras in the air, even with de luxe ground cameras. The cameras are not to blame if I attempt to use them in the air where they were never designed to be used. On the other hand, I have made pictures as good as the average vacation snapshot with a little vest-pocket camera when flying several thousand feet above the ground.

I have seen many excellent photographs made with ordinary ground cameras at various heights and I know that it can be done and is being done almost daily by average amateur photographers. However, let me make it clear that they are "air minded" enough to handle their cameras properly in the air and to use such types as are likely to work best when subjected to tremendous wind pressure and other trying conditions.

Well, then, what types of the usual amateur cameras might be expected to make a fair picture from an airplane? The so-called box-camera is ideal so far as shape is concerned. There are no bellows to catch the wind and be torn out by the roots. On the other hand, the speed of the shutter on these cameras, about 1/25 of a second, is not sufficient to stop the motion of the ground unless the plane is at a very great height, and then the lens is not corrected enough to make a clear picture. Furthermore, the vibration of the plane itself would blur the picture. I do not know personally of a good picture being made in the air with one of these moderate priced box-cameras. That does not mean that it has not been done or, perhaps, could not be done; but I do not know of a case.

Coming now to the so-called pocket and vest-pocket cameras with short bel-

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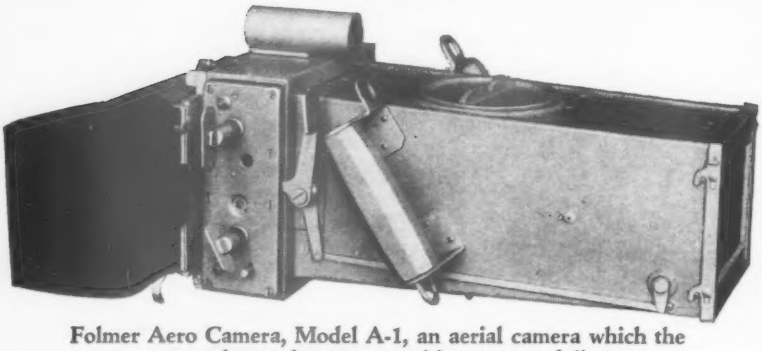
lows, faster shutter-speeds and better lenses fairly good results may be obtained provided the camera is protected as much as possible from the wind and a shutter-speed of about 1/200 of a second is used with the lens-stop set at about F/8 or a larger opening, if the lens has one.



Folmer Aero Camera, Model A-1, an aerial camera which the most advanced amateur could use successfully.

At lower altitudes even this speed of shutter is very likely to show some motion or some blur due to the vibration of the plane. However, if the pilot throttles down the engine for a few seconds and steadies the ship as much as possible during the moment of exposure, some very good results are obtained. I wish to make it clear that much depends upon the conditions which happen to exist at the moment of making the picture. It is very much like trying to make a picture of a breaking wave. One second too soon or too late makes all the difference in the world in getting the best result.

The next general type of camera is the focal-plane shutter outfit which is much used by press-photographers. This type has a wide range of shutter-speeds which are ample to meet all requirements. Then, too, these cameras are fitted with fast anastigmat lenses which permit a large amount of light to pass in the fraction of a second. However, the hoods with which these equipments are fitted to permit viewing the pictures on the ground-glass are as bad as the bellows of the other types of cameras, so far as catching the wind is concerned.

In a number of these models it is possible to trip the shutter without having the hood raised. When this is possible the photographer has all the advantages of the box type camera with virtually no bellows at all exposed to the wind, provided he takes care to have the camera accurately focused on infinity before leaving the ground. All in all, this is perhaps the most efficient ground camera to use in the air. It is not in the moderate-priced class, though, even for ground cameras. I have seen a number of similar types of cameras rebuilt by their owners for aerial work, and the results obtained have been very good. By rebuilt, I mean so protected and arranged that a minimum of lens, bellows and mechanism is exposed to the wind.

There are now several types of small cameras with fast shutters and lenses on the market which use motion-picture film and are similar to the box-cameras already mentioned. These cameras are not movie cameras, but use movie film for a number of small but very clear still pictures. They have no bellows and are so small that they offer very little resistance to the wind. I have seen excellent results obtained with these little cameras in the air. The negatives may be enlarged to a considerable size.

Incidentally, although I have never made any movies in the air, I know that any one of the standard amateur movie cameras now so widely advertised will do excellent work for the reason that they are of the box type of construction and have no bellows to catch the wind; and they are small, light in weight and easily handled. Movies in the air are a success now among the amateurs who like to fly and understand how to manipulate their little cameras.

For the moment let us leave the matter of cameras and discuss a few technical details in an informal way. For the majority of amateurs the use of roll-films will be found best in the air. If the camera is tight, the film is not likely to be forced out of position by wind-pressure and thus cause a blurring of the picture.

Filmpacks are apt to be troublesome as the wind makes it very difficult to get hold of the paper tabs with which a fresh film is pulled into position. Another thing I have found is that light leaks in through the pack where the tabs are torn off. However, by pulling the tabs out—thus bringing a fresh film into position—and not tearing them off but letting them remain attached to the pack, light does not seem to leak in so much.

Glass plates in a plateholder or in a plate-magazine offer little trouble so far as wind-pressure is concerned; but I have had the magazine jam or the slide in the plateholder stick so that my pictures were ruined.

Let me point out that making camera adjustments in a hundred-mile breeze is quite a problem, not to mention the vibration of the ship and perhaps bumpy air which necessitates holding on tightly to the first thing that is at

(Courtesy of Eastman Kodak Company)

Type of aerial photography which is popular with tourists.

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hand. Of course, in a cabin plane the matter of wind-pressure is partly solved as there is apt to be more protection for the camera and the photographer.

At the present time, the efforts of amateur aerial photographers, who are equipped with amateur types of ground cameras, to match the aerial pictures made by Government or commercial photographers are very likely to be disappointing. There is a brilliancy and clearness of detail in the professional aerial picture which few, if any, amateurs will obtain with the equipment they probably have at hand.

The reason is not so much a matter of camera as it is one of plates or films and the proper filters to use with them. By filters I refer to pieces of optically made yellow glass of varying densities of color which are slipped over the lense to hold back the powerful ultra-violet and blue rays of light so that reds, greens, yellows and oranges may have a better chance to impress themselves on the sensitive plate or film. In short, it has been found possible to filter light so that all colors in nature may be reproduced in black and white in their relative tonal values. That is, red will not appear as black or blue as pure white.

In aerial photography filters are used for still another purpose and that is to cut through smoke, haze and mist. Blue and even red filters are used for this purpose, depending on the elevation and the terrain to be photographed. Obviously, the use of filters necessitates an increase of the exposure-time because the light has more to pass through on its way to the plate or film. The density of the color of the filter controls the exposure-time. A two-time filter means that the normal exposure must be increased two times when that particular filter is used. Some filters require ten times the normal exposure because the dark color of the yellow glass does not permit sufficient light to pass in a shorter time.

Although it is true that filters are used a great deal in ground photography, it does not follow that the average amateur photographer is equipped with the kind best adapted to aerial work. However, any kind of a filter is better than none, and it should be used especially if pictures are to be made from any considerable elevation. When used with the correct kind of plate or film the resulting pictures will more nearly approximate those aerial views made by professionals.

The mention of filters necessitates a word about kinds of plates and films to use in order to get the maximum results. The ordinary plate or film used by amateurs is orthochromatic. That is, it is reasonably sensitive to yellows and greens; but it is apt to miss the reds, oranges and other variations of color. By using a filter which holds back the strong ultra-violet and blue rays of light, there is an improvement.

Up to a certain point, the darker the filter the better the color-rendering in the black-and-white print. However, there is such a thing as over correction and this results in unnatural and exaggerated effects. Next we have the panchromatic plate or film which is sensi-

(Continued on page 78)

(Courtesy Fairchild Aerial Surveys)

Lake George, New York. Type of aerial photograph which is popular with summer vacationists.

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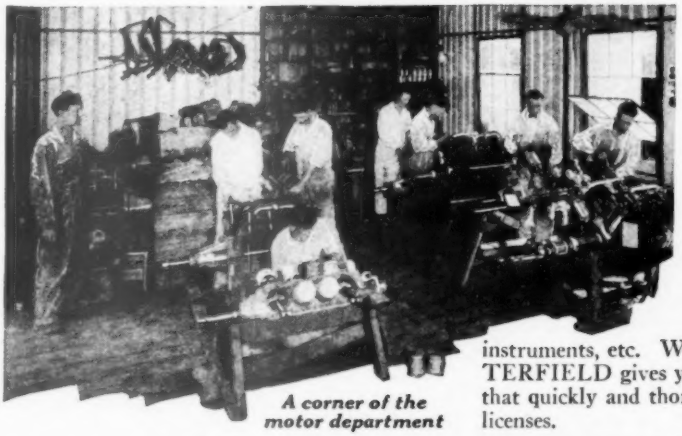
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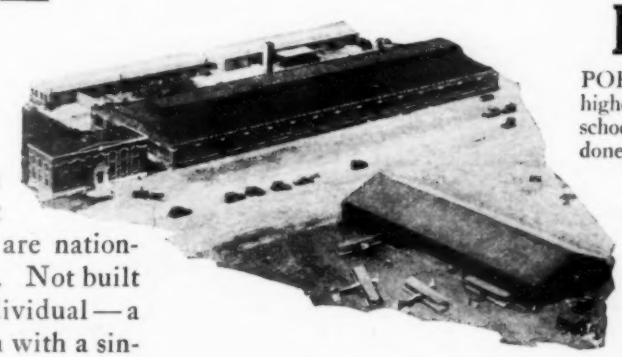

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THE young fellow in the flyer's helmet and coat, who had just climbed out of the plane, stepped over to me. "One of the mechanics just said you were looking for me," he said. "Can I help you?"

"Well, yes," I told him. "You're the flying instructor at this field? I want to see you about learning to fly."

"Fine," said the young man. "Let's go over to my office. What aviation training have you had so far?" he asked. I admitted I hadn't any. "But I know that Aviation is the coming big industry in America," I told him. "I know it's a fascinating business for young men, and that it offers the biggest opportunity ever presented for serious-minded fellows. That's why I'm trying to find a way to get started, by learning to fly at one of the big fields."

"You're right about the future of Aviation," agreed the young man. "But you're going about it in the wrong way to break in. You say you want to learn to fly. But could you read an air map, an inclinometer, an altimeter? Do you know how airplanes are designed—how weather affects flying? No, of course not. Those things are ground studies—fundamental principles, which you have to know first if you're ever going to be a pilot, or anything else connected with flying. Yet, though they are so important, we can't teach them to you here at the field. At least, if we do, it's an expensive proposition, and we have hardly the time or the equipment to teach you properly.

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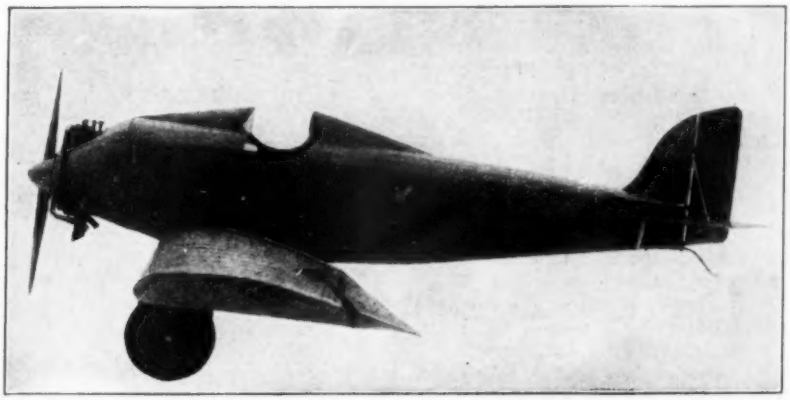

Specifications

Wing span—26 ft.
Wing area—108 sq. ft.
Weight empty—551½ lbs.
Useful load—231½ lbs.
Power plant—Szekely SR-3.
Rated h.p.—40.
Fuel capacity—10 gal.

Performance

High speed—90 m.p.h.
Cruising speed—80 m.p.h.
Landing speed—30 m.p.h.
Cruising range—360 m.

Buhl Sport Airsedan

A three-plane high speed cabin sesquiplane, built by the Buhl Aircraft Company at Marysville, Michigan.

Specifications

Wing span—36 ft.
Wing area—240 sq. ft.
Length—25 ft.
Weight empty—1800 lbs.
Useful load—1000 lbs.
Power plant—Wright J5 or J6.
Rated h.p.—200 at 1800 r.p.m. (J5) or 300 at 2000 r.p.m. (J6).
Fuel capacity—90 gal.
Oil capactiy—10 gal.

Performance

High speed at sea level—J5: 135 m.p.h.; J6: 150 m.p.h.
Cruising speed—J5: 110 m.p.h.; J6: 125 m.p.h.
Landing speed—J5: 45 m.p.h.; J6: 45 m.p.h.

Command-aire Model 3-C-3-A

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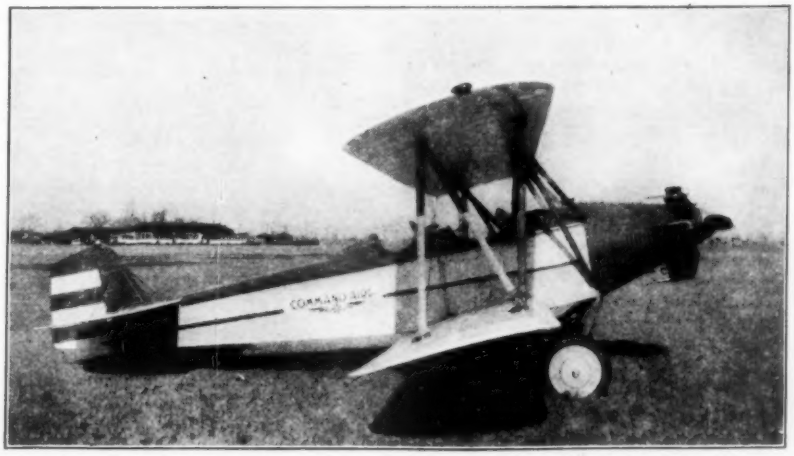

Specifications

Wing span—31 ft. 6 in.
Wind area—303 sq. ft.
Length—24 ft. 6 in.
Weight empty—1280 lbs.
Useful load—865 lbs.
Power plant—Warner-Scarab.
Rated h.p.—110.

Performance

High speed at sea level—107 m.p.h.
Landing speed—33 m.p.h.
Cruising range—416 m.

Simple Aerodynamics

By Alexander Klemin

Centrifugal Force

WHENEVER a body moves in a circle, centrifugal force comes into play. A simple experiment to illustrate centrifugal force can be performed by taking a bottle of milk, open at the top, and tying a piece of string round the neck of the bottle. The bottle can then be swung round and round without a drop of milk being spilt. Centrifugal force acts on the milk outward from the center of the turn and prevents it from flowing out at the open end.

It is somewhat harder to illustrate centrifugal force on a mathematical basis. Newton stated that a body remains at rest or persists in a motion in a given direction unless acted on by some force.

Suppose that a body, M, as shown in Fig. 1, is moving in a circle with center

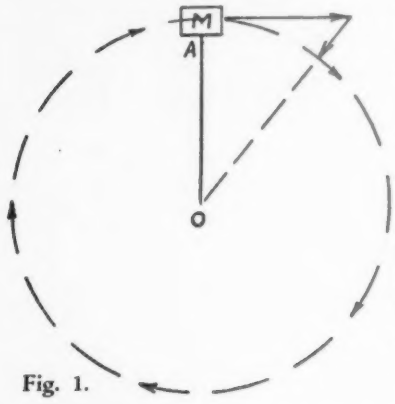

Fig. 1.

O. When the body M is at the point A, its motion for the instant is in a direction perpendicular to the line OA. If it is to continue on in a circular direction, some force must be exercised on it to change its direction of motion. This force, acting towards the center of the circle, is termed centripetal force and is equal and opposite to the centrifugal force. In the case of the bottle of milk, the centripetal force is provided by the pull in the string.

In going round a circle, there is evidently a continual change in the direction of motion, and reflection will show that there is really always a continual acceleration towards the center of the circle. It can be shown mathematically that this acceleration in feet per second is equal to

$$\frac{v^2}{R}$$

where v is the tangential velocity along the circumference of the circle in feet per second, and R is the radius of the circle in feet.

Since force equals mass x acceleration, and mass = weight / g the centrifugal force in pounds, acting on a weight of W pounds will be given by the expression

$$F = \frac{W}{g}\,\frac{v^2}{R}$$

Example

A bottle of milk weighing 3 pounds is swung round at the end of a 3 foot string at the rate of once a second. What is the pull in the string?

The circumference of the circle is $2\pi R = 2 \times 3.14 \times 3 = 18.84$ feet. Therefore, the tangential velocity is 18.84 feet/second. The centrifugal force $= \frac{W}{g}\,\frac{v^2}{R}$

$$= \frac{3}{32.2} \times \frac{18.84^2}{3} = 11.5 \text{ pounds.}$$

It should be noted carefully that (a) the greater the tangential velocity, the greater the centrifugal force (b) for a given tangential velocity, the centrifugal force will be larger for a smaller radius of turn.

A Force to Counteract Centrifugal Force Needed on Turns

Whenever a body moves in a circle, a centripetal force to counteract the centrifugal force is needed. When a man turns a corner on a bicycle, he bends his body and the bicycle inwards for this reason. On a circular automobile racing track, the track slopes inwards to its center. The explanation of the bank in making an airplane turn is based on the same principle.

Equilibrium of Forces on a Banked Turn

If a pilot tried to make a flat turn, that is without inclining or banking his machine, centrifugal force would make his machine sideslip or skid away from the center of the turn. When the machine is correctly banked, as shown in Fig. 2, there is equilibrium of forces and the plane moves on the circumference of a huge circle, without skidding either in or out. As can be seen from the sketch, the wing tip nearest the center of the turn is inclined downwards. The lift of the wings is also inclined inwards, and counteracts not only the force of gravity but also the centrifugal force. If $\emptyset$ is the angle of bank, we can resolve the

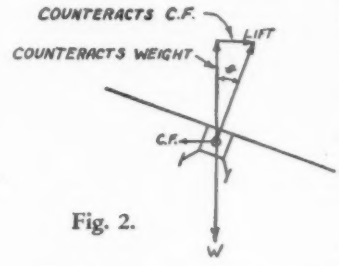

Fig. 2.

lift force into two components and get the following equations, where v = speed in feet per second.

(I) $L \sin\emptyset = \text{Centrifugal force} = \frac{W}{g}\,\frac{v^2}{R}$

(II) $L \cos\emptyset = W$

Dividing the first equation by the second, we get

(III) $\tan\emptyset = \frac{v^2}{gR}$

A number of interesting conclusions emerge from the diagram of Fig. 2 and from these equations.

The lift of the wings in a turn must be greater than the weight of the plane.

The steeper the angle of bank the greater is the lift.

The steeper the angle of bank, the greater is the value of $\frac{v^2}{gR}$ and the greater the centrifugal force $\frac{Wv^2}{gR}$

For a given angle of bank, $\frac{v^2}{gR}$ always has the same value, and the centrifugal force has the same value. We can, however, make v^2 large, and R large, or make v^2 small and R small.

This means that at any angle of bank, the pilot can fly fast but on a large radius, or fly slowly and on a small radius.

We can add another convenient equation:

since $L \cos\emptyset = W$, therefore

(IV) $L = \frac{W}{\cos\emptyset} = K_r A V^2.$

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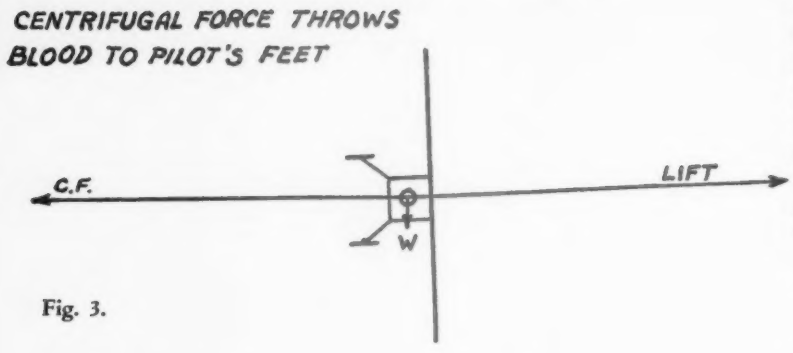

Fig. 3.

It follows from this that on a turn, at a given speed, since the lift is greater than the weight, the lift coefficient must be greater than in straightaway flight. In other words, on a turn at a given speed, the angle of incidence must be greater than in straightaway flight.

A few examples will make our ideas clearer:

Examples

(a) A plane of 1,600 pounds gross weight is turning at 100 miles per hour, with an angle of bank of 45 degrees. What is the centrifugal force? The lift of the wings? The radius of the turn?

Since the plane is banked at 45 degrees, the weight is equal to the centrifugal force, which is therefore 1,600 pounds. The lift is the resultant of the weight and centrifugal force $= \sqrt{1600^2 + 1600^2} = 2260$ pounds. The speed is 146.7 feet per second and tan $45° = 1$ therefore $1 = \frac{v^2}{gR} = \frac{(146.7)^2}{32.2 \times R}$ and the radius of the turn is 667 feet, approximately.

(b) If this machine of 1600 pounds is provided with a Clark Y wing of 200 square feet, what will be the angle of incidence in straightaway flight at 90 miles

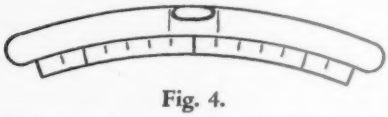

Fig. 4.

an hour and on a bank of 30 degrees at 90 miles an hour?

In straight flight $W = K_y A V^2$ and $K_y = \frac{W}{A V^2} = \frac{1600}{200 \times 90^2} = .00099$. From the curves and tables for Clark Y in Article 5, we see that this corresponds to an angle of incidence of —0.25°

On the 30° bank, $L = \frac{W}{\cos \phi} = \frac{W}{\cos 30°}$ $= \frac{1600}{.8660} = 1850$ pounds. Hence $K_y = \frac{L}{A V^2} = \frac{1850}{200 \times 90^2} = .00145$. From Fig. 10 of Article 5, we see that the angle of incidence must be a little over 2 degrees, or considerably more than on the straightaway.

Why a Pilot May Lose Consciousness on a Very Fast, Steep Bank

In the Pulitzer Cup races, where pilots made very fast steep turns, they would lose consciousness for brief intervals of time. This is explained by the diagram of Fig. 3. The centrifugal force in such turns became very great, and the pilot's body would assume an almost horizontal position. The centrifugal force would act on the blood in his brain and tend to force it in the direction of his feet. When the blood was forced from his brain he became unconscious; and it was only after the plane had straightened out and the blood returned to his brain that he regained consciousness.

The Lateral Inclinometer on a Bank

To show the pilot whether his plane is on a level keel or not, a lateral inclinometer is employed, which in its simplest form is a curved glass tube, filled with colored alcohol, with an air bubble which is at the center of the tube when the plane is level. This instrument is shown in Fig. 4. When the plane rolls sidewise, the air bubble travels in the direction of the high wing tip and by means of a graduated scale indicates the degree of bank. On a turn the air bubble is subjected to both gravity and centrifugal force, and if the turn is correctly

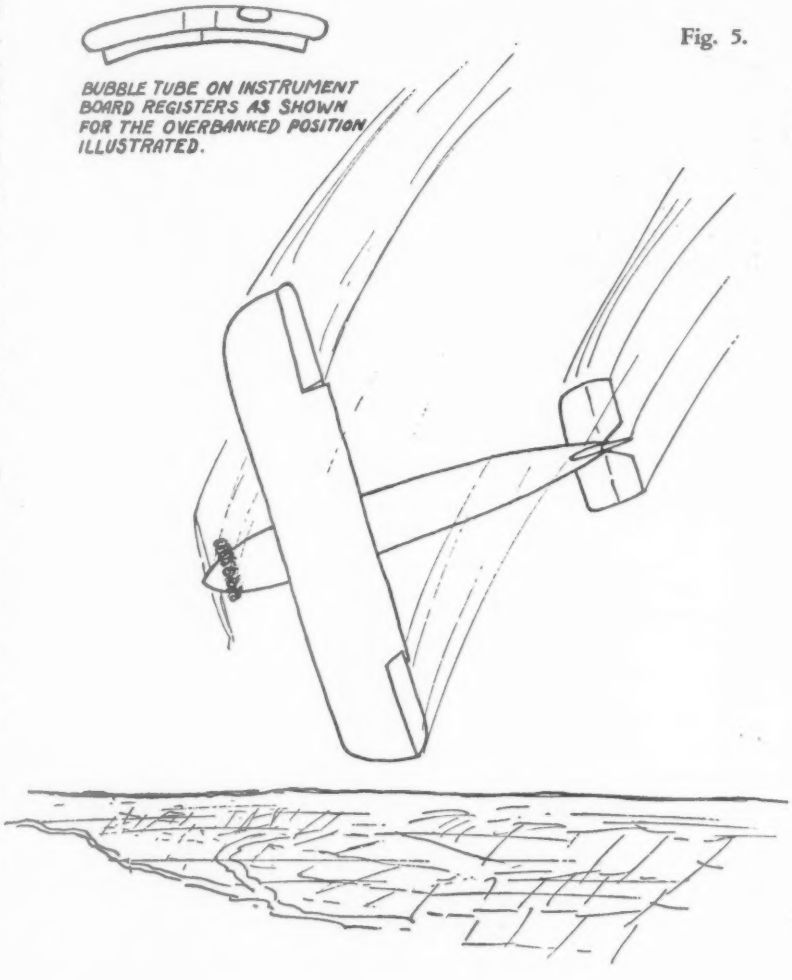

Fig. 5.

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BY J. C. ROYLE
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Control by Flaps—Ailerons and their Functions—Flippers and their Function—Rudder—Co-ordination of Controls.

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CHAPTER FOUR—Interesting Points in Design
Aspect Ratio—Stagger—Monoplane or Biplane—Tail Skid— Airplane Engines—Water Cooling vs. Air Cooling—Cost of Airplane Engines—The Propellor.

CHAPTER FIVE—Construction of Airplanes
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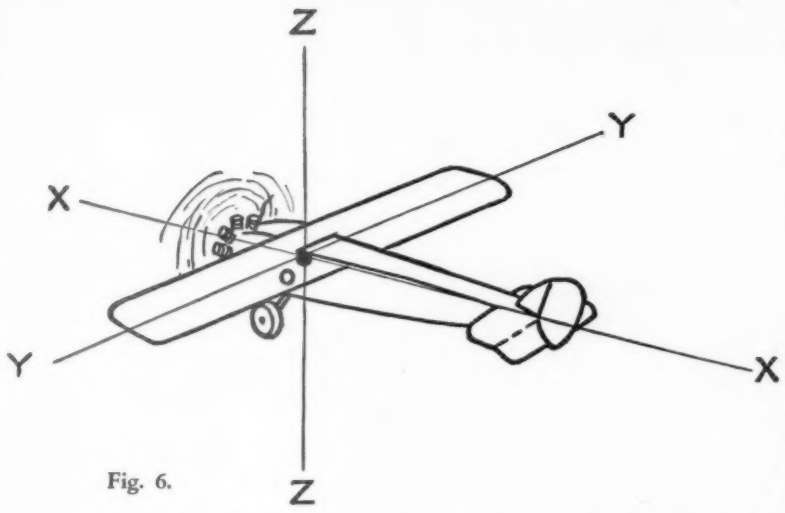

Fig. 6.

executed, the bubble remains in the exact center of the tube.

Incorrect Banking

If on a turn the pilot banks the plane too much, it will sideslip towards the center of the turn. If the plane is underbanked, it will skid out away from the center of the turn. This is illustrated in Fig. 5. The inclinometer bubble, central in a correct bank, will move out as the airplane sideslips towards the center of the turn, and conversely move in as the plane skids out.

More Speed and Power on a Turn

We have seen that a turn can be made at the same speed as in rectilinear or straightaway flight but at a higher angle of incidence, so as to give the greater lift required on the turn. If a turn is made at the same angle of incidence as in rectilinear flight, then the speed must be increased to give the extra lift.

In either case, same speed or same incidence, the power on the turn must be greater.

The power required for the wing is $\frac{K_x A V^3}{375}$ (see Article 6)

At the same speed, but at a higher angle of incidence on the turn, the K_x and the power required are likely to be greater. At the same angle of incidence but at a higher speed on the turn the power will be greater because it varies as V^3.

We can now answer the question as to how the pilot can act so as to make a turn without losing altitude. If he is flying at maximum speed, full throttle, he evidently has no reserve of power to make a turn at the same speed. Therefore he has to nose the machine up a little so as to increase the angle of incidence and fly at less than top speed on the turn.

If the pilot is flying in a straight line, with the engine somewhat throttled, then he has two alternatives in making a turn. One is to make the turn at the same angle of incidence, but greater speed, in which case he has to open up his engine. The other alternative is again to raise the nose slightly and make the turn at lower speed.

It is of course possible to make a turn at the maximum speed of the airplane, and even beyond this speed. But in that case gravity has to supplement the power of the engine, and height has to be lost on the turn.

Example

The plane of 1600 pounds for which performance calculations were made in Article 6, needed 31.8 horsepower in rectilinear flight at 90 miles per hour. If a banked turn of 30 degrees is made at the same angle of incidence as in straight flight, what is the speed, and what is the power required?

The lift $L = \frac{W}{\cos\emptyset} = \frac{1600}{\cos 30^\circ} = \frac{1600}{.866} =$ 1850.

In straight flight $1600 = K_y A V_1^2 = K_y A (90)^2$; on the turn $1850 = K_y A (V_2)^2$, hence $\frac{1600}{1850} = \frac{90^2}{V_2^2}$ and the speed on the turn works out 97 miles per hour. At the same angle of incidence, the power varies as the cube of the speed. Therefore power required on the turn equals $\frac{31.8 \times (97)^3}{(90)^3} = 39.7$ horse-power.

Learning to Make a Turn

After a student has learned to fly straight and on an even keel, the next thing to learn is how to make a correct turn. A turn may require the application of rudder, ailerons and elevator, and is one of the most difficult as well as one of the most essential maneuvers to learn. It seems necessary at this stage to study the properties of the control surfaces.

The Control Surfaces

The control of an airplane appears to be so instinctive a matter that we have apparently taken for granted hitherto the functions and properties of the control surfaces.

The easiest way to understand the maneuvers of the airplane is to imagine that it has three axes at right angles to one another, and meeting at the center of gravity. These three axes are shown in Fig. 6. There is the longitudinal axis which runs the length of the airplane. It is marked XX in the diagram. At right angles to this there is the transverse or lateral axis YY. Then there is the vertical or normal axis ZZ.

These axes are considered fixed in the airplane, and move with it in space.

The Wright Brothers realized the necessity of having independent control about the three axes of the airplane and achieved such control.

The first control is the elevator which

(Continued on page 76)

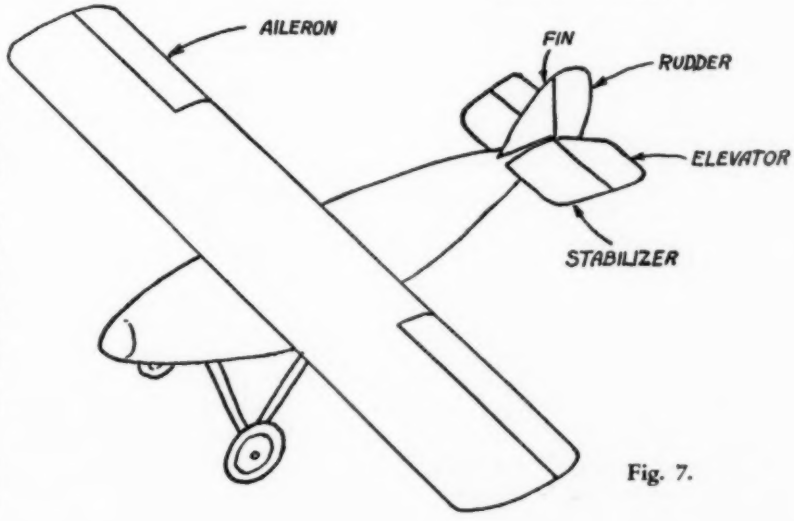

Fig. 7.

Naval Influence on Aircraft Design

By Andrew R. Boone

NAVAL and military influence on the design of aircraft has been marked, especially insofar as use of aircraft aboard ships is concerned. The Army has not required the same combination of qualities in planes that the Navy has demanded. The requirements of the Navy for a bomber to operate from a land base may approximate those of the Army for a similar machine, but a bomber to operate from shipboard must be an entirely different creature.

The types of aircraft used by the Navy are determined by their tactical employment. There is a highly specialized service for each type. While their services are specialized, the types of aircraft manifestly must be as few as is consistent with the carrying out of a naval aviation mission.

"All the aircraft of these types must be of minimum size and weight," Commander E. E. Wilson, chief of staff, Aircraft Squadrons, Battle Fleet, explains, "and must have maximum performance under the restrictions of low landing-speed and adaptability to landplane, seaplane, and in some cases amphibian uses.

"The development of these types has been accomplished in two basic steps: the first a reduction in power-plant weight through the development of the air-cooled engine; second, a reduction in structural weight through the use of light alloys and the ingenious design of light weight rugged structures.

"The number of types has been kept down by specialization for performance in the fighter class, and by multiplying the functions while still retaining the performance in the observation and torpedo-bombing classes. Design and tactics have gone forward hand in hand, each influencing the other."

The most recent plane developed to meet rigid Navy requirements is the Boeing F4B, the newest shipboard fighter. In designing this plane the Boeing Company met Navy demands that the plane, the power plant and the disposable load be of equal weight.

Not only has a strictly utilitarian end been met in these planes but also they represent the highest development to date in fighters powered with air-cooled engines. For the first time, as exemplified in this plane, a United States manufacturer has streamlined an air-cooled engine and produced a plane which combines high speed in the air with relatively low landing speed. The new Boeing lands more slowly than any previous Navy fighter, and outperforms all others in the air. These planes were designed for carrier use primarily and the first two have been delivered to the naval air stations at Anacostia and San Diego for experiment. Later it is contemplated that others will be placed aboard the carriers Saratoga, Lexington and Langley. They will be used for fighting and light bombing operations.

This is the smallest fighter yet manufactured, and it has been so designed to meet rigid requirements. The plane measures 30 feet from wing tip to tip and is 20 feet 3 inches long. This compares with 36 feet and 26 feet for its immediate predecessor.

In seeking this plane the Navy made known to the manufacturer three needs: a lighter plane, a faster plane and a smaller plane. Accordingly it has been constructed and no strength sacrificed. The plane weighs 800 pounds, the engine and other parts of the power plant 800 pounds, and it has a disposable load of 800 pounds. Exclusive of fuel, lubricating oil and pilot the plane can carry an offensive load consisting of guns, ammunition and bombs of approximately 300 pounds. Its cruising radius is sufficient to permit any necessary operation from a land station, carrier or battleship.

Two changes of particular interest have been made in the F4B. The fuselage and control surfaces are constructed of duralumin while the wings are constructed of wood and fabric. Control surfaces have been corrugated for greater strength. The fuselage presents a narrow appearance and in fact is less bulky than the earlier fighters.

In streamlining the engine, the metal fuselage covering has been projected between the cylinders of the engine and rounded in front. From the pilot's point of view this is important, for it permits him to see between the cylinders the deck of a carrier and he can land with greater precision and safety.

From one point of view the advent of the F4B comes as the high point in naval aviation development for 1928. Viewed more broadly, however, the year will go down in the history of naval aviation as the interval during which the final rounding out into a concrete whole of the Naval Air Force has been accomplished.

There are at present attached to the battle and scouting fleets a fighting organization of over 250 airplanes. These are made up of fighters, scouters and torpedo-bombing planes. "They represent the highest development of aeronautics to date," in the opinion of Rear Admiral J. M. Reeves, commander, Aircraft Squadrons, Battle Fleet.

This is the external picture, however. Naval aviation constitutes something more than a great number of airplanes. These planes must be used to assist the battle fleet to attain victories, and if they do not accomplish their mission they fail and jeopardize the fleet. Manifestly the planes must be carried aboard ship or they cannot be present during a fleet engagement.

"Since the present limitations of aircraft preclude their carrying the offensive to an enemy," Commander Wilson has explained, "it becomes necessary that the fleet aircraft be embarked on the vessels of the fleet. At present it is im-

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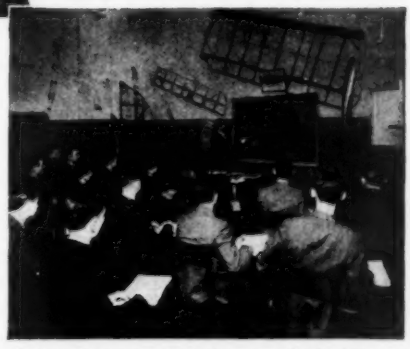

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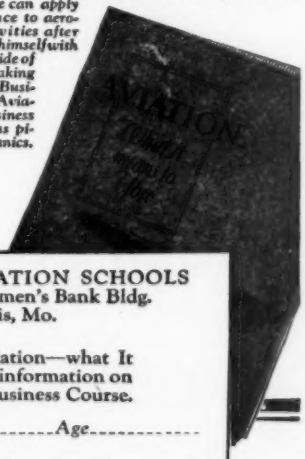

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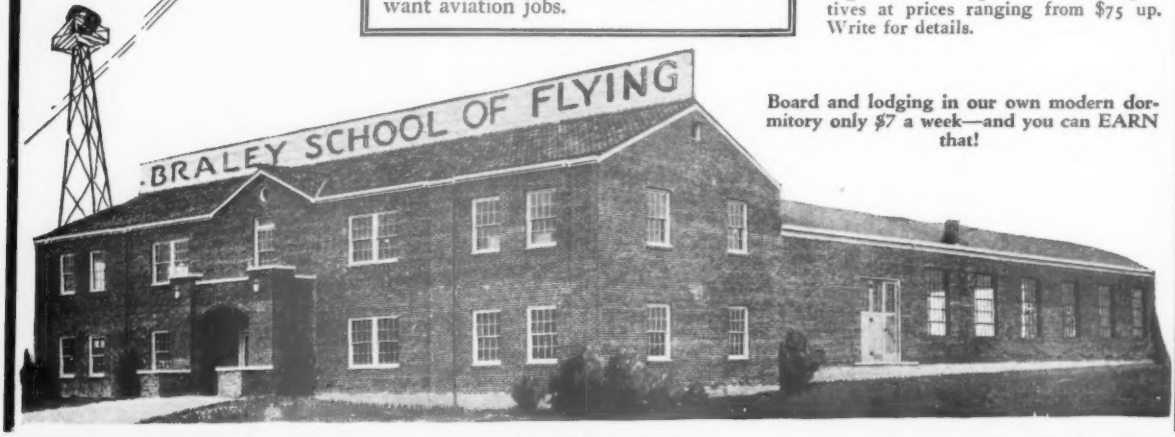

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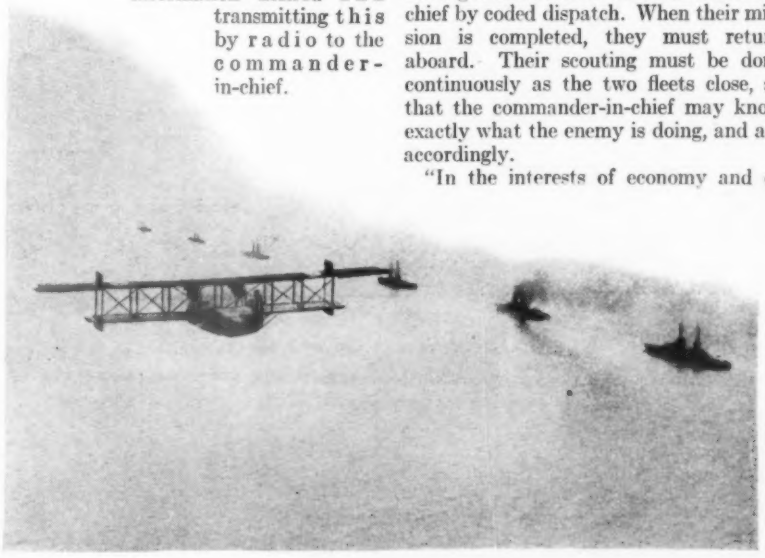
possible for any military or naval airplane to fly to the coast of a distant overseas enemy, drop its destructive missiles, and return to its home base. With its fleet, however, a nation can advance its bases step by step and carry on the offensive. Therefore, the first requisite of fleet aircraft is that they operate from the decks of the vessels of the fleet.

"This statement applies to all save patrol-type aircraft. At present these are large flying boats, too heavy to operate from the decks of vessels. As an alternative, they are built to be seaworthy and airworthy, so that they can take passage with the fleet, using tenders in the fleet as their bases. These aircraft will operate normally from sheltered harbors, patrolling the seas against enemy submarines, surface vessels and aircraft, reporting what they see, and attacking with bombs when directed to do so."

All the other planes are carried aboard ship on the carriers, the battleships and light cruisers. The Aircraft Squadrons, Battle Fleet, comprise 15 squadrons, a total of 206 aircraft. Designs of all these aircraft have been worked out since the war. During the World War American naval aviation participation was confined largely to submarine patrol and similar coast service with the big flying boat.

Manifestly space limitations have not involved the flying boat to the extent that the other types of planes have been required to meet.

All naval airplanes must meet definite needs and as many of these as possible. During an engagement, for instance, each commander-in-chief will use both the surface and air scouts, at the same time attempting to prevent enemy airplanes from obtaining any information of his movements. Scouting planes must therefore be capable of penetrating enemy screens, ascertaining information desired and transmitting this by radio to the commander-in-chief.



"Since radio is required," Commander Wilson explains, "scouts should be two-seaters. Unless the battleships' decks are fitted for landing aboard, the battleship two-seaters must be seaplanes, and the battleships must be fitted with catapults or cranes so that they can be launched. To return aboard, the planes must land alongside in the water and be hoisted in. If the sea is rough, this is impracticable. This hoisting-in process requires that the battleship be stopped, and no commander-in-chief will ordinarily care to do this. He must, however, scout in all weather. Battleship planes will, therefore, not ordinarily be used for scouting, but for spotting the vessels' gunfire.

"The two-seaters on the airplane-carriers, however, are available for scouting, since they can take off and land on the decks of the carriers regardless of the state of the sea and while the carriers are moving, and their operation does not restrict the movements of the fleet.

"Scouts are therefore carrier two-seaters. They will take off and scout according to a plan designed to cover all of the area possible in the probable position of the enemy. By means of radio they will report their position and the contacts they make. They carry guns to protect themselves against enemy attack.

"Since their mission is to obtain information, they will not be drawn aside by local combat, but will push on through in an effort to determine where the enemy is and how his vessels are disposed. They must get this back to the commander-in-chief by coded dispatch. When their mission is completed, they must return aboard. Their scouting must be done continuously as the two fleets close, so that the commander-in-chief may know exactly what the enemy is doing, and act accordingly.

"In the interests of economy and of facility of maintenance and operation afloat, the spotters and the scouts may be the same type of airplane. Since one is flown as a seaplane from the battleships and the other as a landplane from the carriers, they must be readily convertible from landplanes to seaplanes, and capable of being catapulted as either. They must be able to land more slowly than is necessary on shore, so that they can work in rough seas or land easily on the restricted decks of the carriers. At the same time, they must be capable of better performance than any possible enemy aircraft. Manifestly, conditions may arise in which the carrier planes may be obliged to land in the water, and the battleship spotters may find it very necessary to come aboard the carriers. An amphibian will be the ideal solution for this, if such an airplane could be built that would have very high performance.

"The commander-in-chief of each fleet, having obtained information about the enemy, will immediately endeavor to attack, having as his first objective the enemy carriers. If he can sink these he will put out the eyes of the enemy fleet and draw a lot of the enemy's sting by depriving him of his air offensive. The commander-in-chief will, therefore, immediately drive home an attack. For this purpose he has at least two weapons; his heavy bombers and his fighting planes equipped with light bombs.

"If the range permits, he will no doubt send off his bombers, escorted by fighters. The fighters will endeavor to drive off enemy defensive planes and penetrate the enemy screen to the point where they can attack with light bombs. The bombers will then try to get in and attack from altitude. Torpedo planes may drop torpedoes, if this weapon appears desirable by virtue of the tactical situa-

A flight of fast Navy combat ships getting into position to lay a screen.

tion as influenced by weather and other conditions.

"The fighters which the commander-in-chief will use are single-seaters of very high performance. Having a normal armament of machine guns, they must have the maximum performance possible in craft of their type. They must obtain this performance without sacrificing low landing-speed, since this is very necessary to carrier operation. They must carry a secondary armament of bombs, and as heavy a load of these as is possible.

"They are landplanes, operating from the decks of the carriers. They are equipped with some form of emergency flotation to keep them afloat for a reasonable period in case of forced landing at sea. They must carry the arresting gear necessary for landing on the carriers. In spite of these requirements, which are not imposed on shore-based single-seat fighters, they must be able to outperform any aircraft they may encounter.

"The torpedo-bombers for this offensive work must also be carrier-based landplanes equipped with arresting gear and emergency flotation-gear. They must get off in the short run of the carrier deck burdened with the 2000-lb. torpedo or a bomb load of corresponding weight. They must have machine-gun protection, must be equipped with radio for communication, and must be capable of navigating a considerable range. With all this, they must be small enough to be carried and handled on the carriers' decks. They must have speed and maneuverability. They must be light, handy airplanes if they are to be flown on and off the decks.

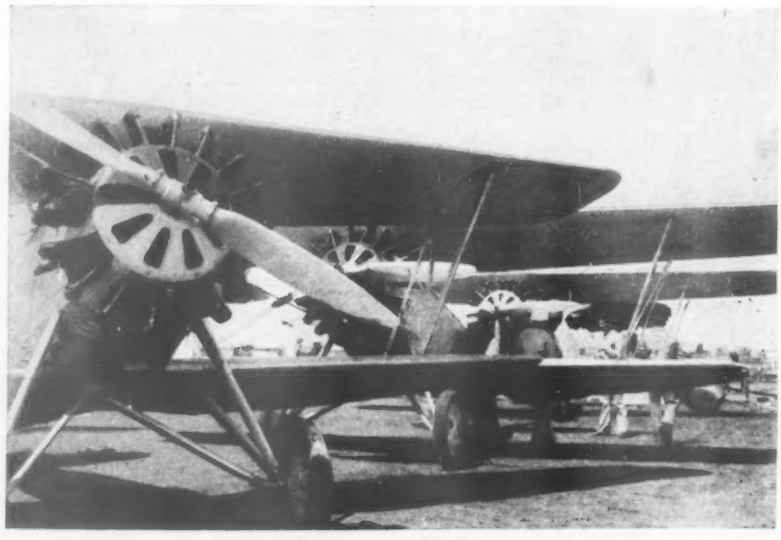
"The commander-in-chief, in addition to taking the offensive against an enemy carrier and protecting his own fleet against an enemy offensive, will attack the enemy battle line, which, by a process of attrition, he will hope to wear down before the main engagement, thus increasing his chances of success. For this purpose the attack will be coordinated with that made on the enemy carrier. The battleships will have anti-aircraft protection in the form of guns and machine-guns of intermediate caliber. The developments to date in controlling these anti-aircraft batteries have been so rapid as greatly to endanger bombers approaching from altitude or torpedo planes approaching close to the water.

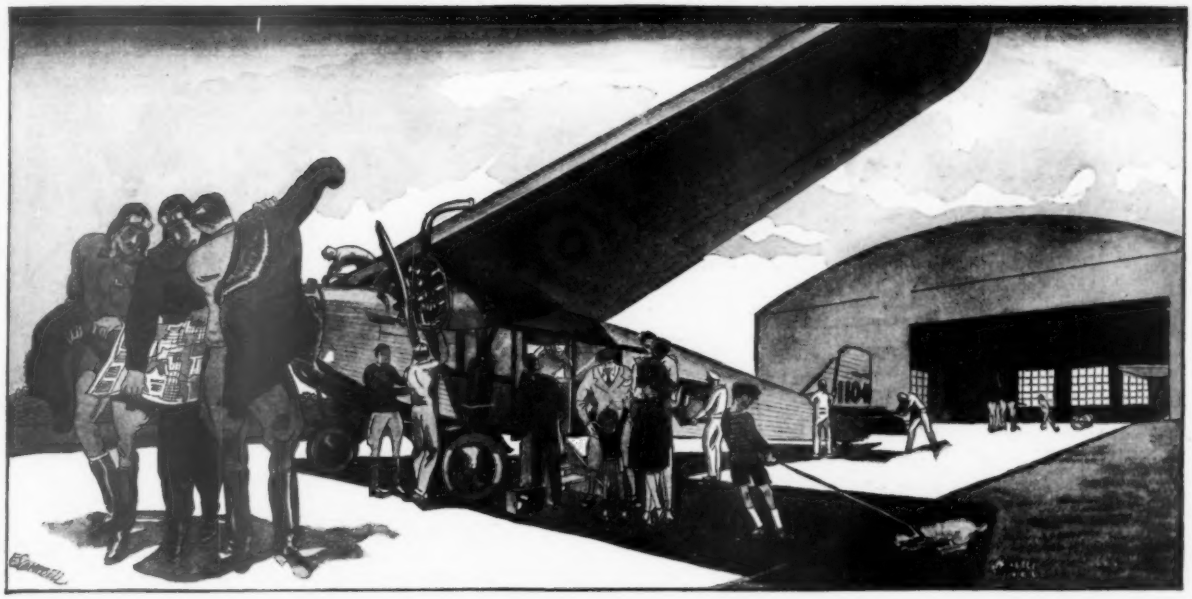
"These guns are no longer scorned by pilots. There are, however, means of combating them. The bombers may take advantage of cloud concealment. The torpedo planes may be accompanied by smoke layers, which may lay a curtain through which the torpedo planes can suddenly attack. The fighting planes, equipped with light bombs, may dive from the sun or cloud concealment onto the enemy battleship, raining a storm of machine-gun bullets and small bombs into the anti-aircraft batteries, with the idea of making them untenable.

"This attack, coordinated with the torpedo and bombing attack, may give the bombing and torpedo planes a better chance of getting home. Even though the torpedo or bombing attack may not be successful in sinking a vessel, if it disables one or two of them to the extent of reducing the speed of the enemy fleet, a distinct advantage will be had."

A very interesting practical demonstration of the effectiveness of aircraft in fleet maneuvers was furnished during the final tactical exercises of the Battle Fleet Concentration during the last week in February. The aircraft squadrons carried out numerous missions, including scouting, smoke laying, bombing, torpedo dropping, light bombing, and combat. The chief emphasis was placed on coordination of the attack of the air forces with that of the main battle line. One of the squadrons, with divisions operating separately, delivered simultaneous, three-direction, diving bombing attacks on the first and third ships in the column. The second division followed this up with an echelon attack on the second ship. The final maneuver consisted of a heavy bombing attack. Incidentally, during these operations, all records of the aircraft carrier Lexington for take-offs and landings were broken. No casualties marred the deck operations.

Navy fighters. The engine cowlings are of different colors for purposes of identification during air combats.





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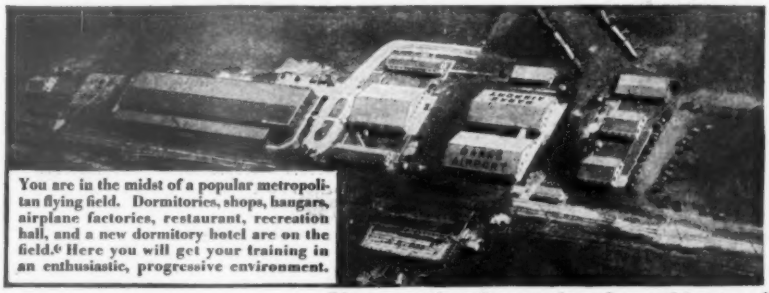

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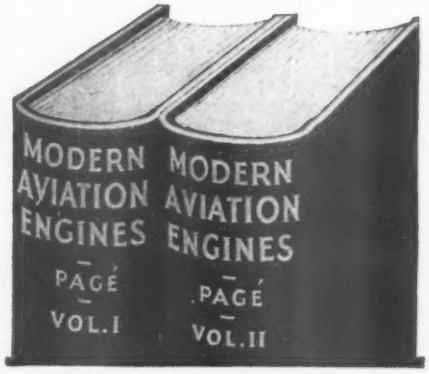

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Washington and Aeronautics

By Fred DeWitt Shelton

THE American aeronautical industry may be said to have been almost incubated and nurtured by Congress and the Federal Government. Other industries face a constant struggle to keep down control and regulation by the government. Aeronautics, in contrast, asked for regulation—and got it. The result is that today the aircraft producers and the air transport industry look to Washington not only for inspiration but for contracts.

It seems worth while, therefore, by way of gauging the immediate prospects ahead, to look at the Washington situation, the aeronautical issues likely to receive attention in Congress, and the part the various Federal Government agencies are playing in things aeronautical.

Congress Had to Be Sold

This close cooperation between government and the aeronautical business has not just grown out of the willing minds of the heads of the administrative departments. It has been necessary to sell aviation to Congress. That did not come easily either. There used to be a strenuous struggle to get appropriations for army and navy aircraft and personnel and even now estimates are usually trimmed in the final appropriation bills. Nevertheless, Congressmen are waking up to the potentialities of flying and now it is not so very hard to get through any bill designed to promote this purpose if the bill has the earnest sponsorship of the executive branch of the government.

In the last session, Congress even took the initiative and put a rider on an army appropriation bill to the effect that the once much touted and notorious Liberty motor must be discarded in favor of modern motors.

A leader in aeronautical legislation in the House is Representative Kelly, of Braddock, Pennsylvania. His sponsorship has hastened passage of air mail laws that have meant much to American aviation. He is looking ahead and planning new ways to provide helpful legislation.

One "Air-minded" Senator

In the Senate, Senator Hiram Bingham, of Connecticut, stands out as an "air-minded" legislator who sees ahead and wants to put America at the front in the air. His interest springs from active service in the air forces during the World War.

First and foremost among the agencies that are aiding aviation is the Post Office Department which breathed life into the slumbering industry during the doldrum days of the post-war let-down. Air mail contracts kept the motors of air craft humming and even now with a quickened public interest in flying the mail routes are the back bone of commercial aviation. This has been accomplished through the Contract Air Mail Act whereby operation of the transcontinental air mail service was transferred from the Post Office Department to private bidders. Subsequently there has been legislation to simplify air mail rates, thus curing a complex and confused situation and producing rapid increases in the volume of mail carried by air routes.

Despite the rapid expansion of the air mail service, far-reaching plans exist for new lines throughout this country and in foreign ports. Lack of suitable airports and beacon lights retard this development. Cities must provide the former. The government is providing the lights as fast as appropriations for that purpose are made available.

Congress last spring passed a law authorizing establishment of mail service to foreign countries. Already contracts are being let for mail lines to South America and Central America.

The Kelly Bill

For a time this spring it looked as if the newly launched air service to the Canal Zone was threatened because the original foreign air mail law did not provide for carriage of return mail originating in foreign countries. Congressman Kelly, however, worked persistently for modification of the law and succeeded in getting his bill through Congress despite a bad legislative jam that threatened the success of all new legislation.

A further speeding up of the mails is contemplated by a proposal sponsored by Representative Kelly whereby mail would be sorted in transit and dumped in bags from flying planes. Thus much of the delay now experienced in getting mail from airports to the post offices would be overcome.

The art of flying is well served also by the Air Corps of the Army and the Bureau of Aeronautics of the Navy. An awakened Congress authorized a five-year program which goes far towards making the air service a truly great part of our national defense. Orders for motors and planes spurred manufacturers to greater production and experimentation for improving their product. In the next fiscal year over 700 airplanes will be added to our equipment for defense.

Under this program we will have, in 1932, some 1,000 airplanes in the Navy and an Army strength of 1,800 planes. That, of course, will not be the stopping point; it is only the immediate objective. Even now, those responsible for our national defense in the air are planning for future needs. Congress, in the next year or two, will be asked for new authorization for an additional aeronautical program for the Army and Navy.

Personnel a Problem

There is no great problem of new airplanes under the five-year program. They are coming along on schedule. But personnel is a serious problem. Civilian aircraft and air transport companies are growing rapidly. They must have seasoned pilots and mechanics and virtually their only source is the Army and Navy. The raw recruit that joins up for a three-year hitch finds himself at the end of the enlistment a trained air mechanic and able to command pay far in excess of what he can hope for from Uncle Sam. So the Army loses him. It is the same with respect to officers. The reputable air transport lines must guard their human cargoes with unusual care. They demand pilots with at least 1,000 flying hours to their credit and about the only place they can find them is in the Army and Navy officer personnel.

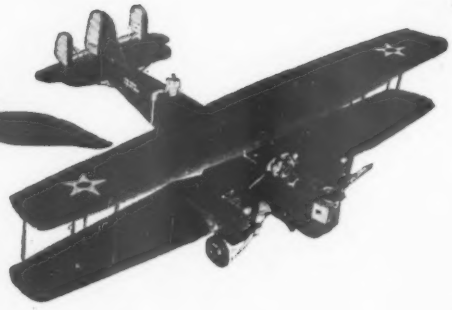
In a generous spirited way this is all to the good since the aviators thus graduated into civil life form a reserve corps that can be called to arms in a war emergency. Nevertheless, those devoted members of the air services can not be blamed if they seek in some way to preserve their ranks, to work for continuity of personnel, and to engender esprit de corps. Thus, we hear persistent agitation for a separate promotion list for the air corps. Since casualties through death and separations through resignations occur at a much higher rate in the air service it is argued that men in that service ought to enjoy promotion at a higher rate rather than to take their turn with all the branches.

Separate Promotion

A separate promotion bill for the Army Air Corps has been regularly proposed in Congress for several years. Always, however, it has become involved in a spirited controversy surrounding a general revision of the entire promotion list and the result has been no legislation. Secretary of War Dwight Davis was for the separate air corps promotion list.

(Continued on page 78)

WANTED PILOTS



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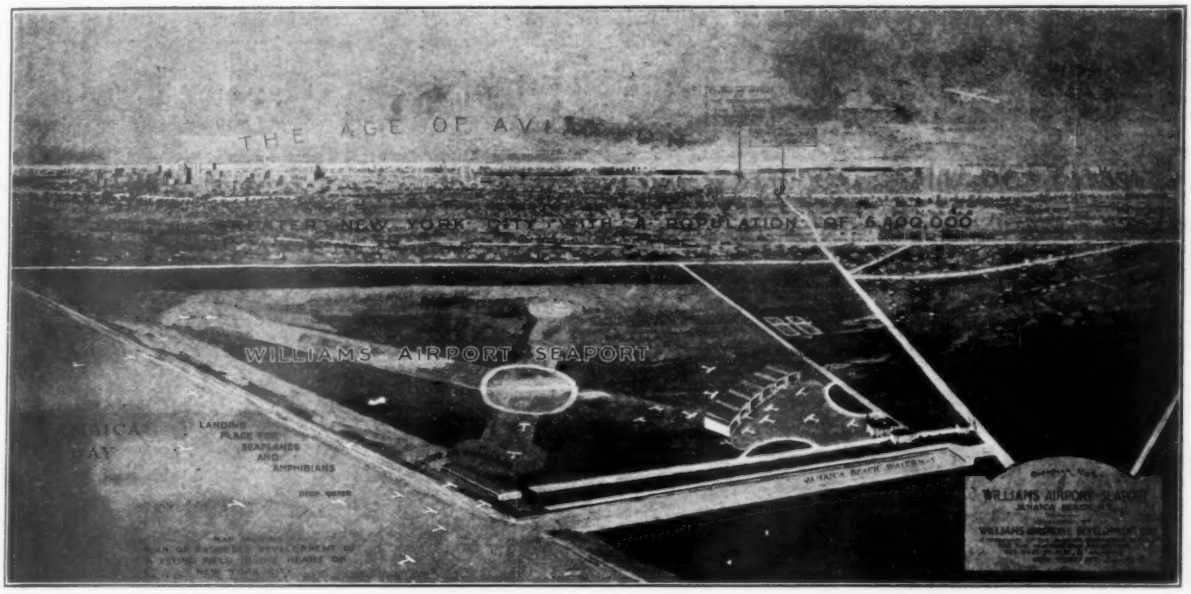

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Simple Aerodynamics

(Continued from page 63)

noses the plane down or up, or pitches it about the transverse or lateral axis YY. The elevator is hinged in back of the stabilizer (whose properties we shall study later) as shown in Fig. 7. When the elevator is turned up, the air strikes it from above; there is a downward force on the elevator, and the nose of the airplane rises. When the elevator is turned down, the air strikes it from below, the force on the elevator is from below, and the nose of the plane is depressed. To actuate the elevator, the control stick is moved back and forth. Pushing forward on the stick, as can be easily gathered from Fig. 8, turns the elevator down and depresses the nose—a perfectly instinctive maneuver. Pulling the stick back, raises the nose of the plane.

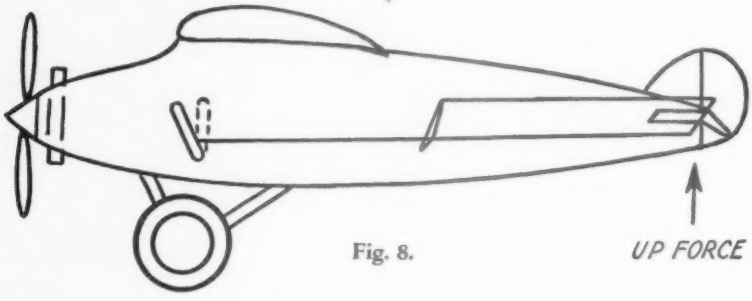
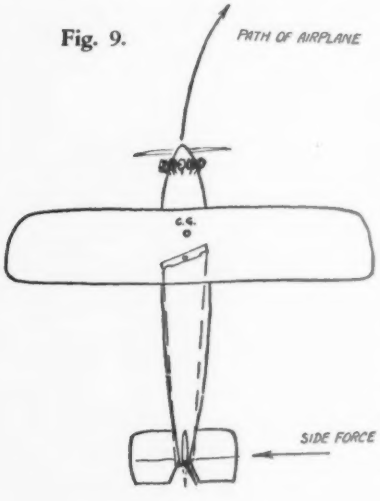


Fig. 8.

The action of the rudder and rudder bar is illustrated in Fig. 9. Pushing the right foot forward, turns the rudder to the right. The air strikes it on the right side, and the plane turns to the right. Giving right rudder means starting a turn to the right therefore. The rudder evidently controls the airplane about the vertical or normal axis ZZ.

Fig. 9.



The ailerons are hinged in back of the wing, toward its end. The ailerons are actuated by the control stick, and as can be seen from Fig. 10, the connecting system between the stick and the ailerons is such that when the stick is pushed to the right, the right aileron is turned up, the left aileron is turned down. The right aileron experiences a force from above, the left aileron a greater force from below. Accordingly the airplane rolls down on the right side. The ailerons control the movement of the airplane about the longitudinal axis XX.

Turning about the transverse axis YY is termed pitching.

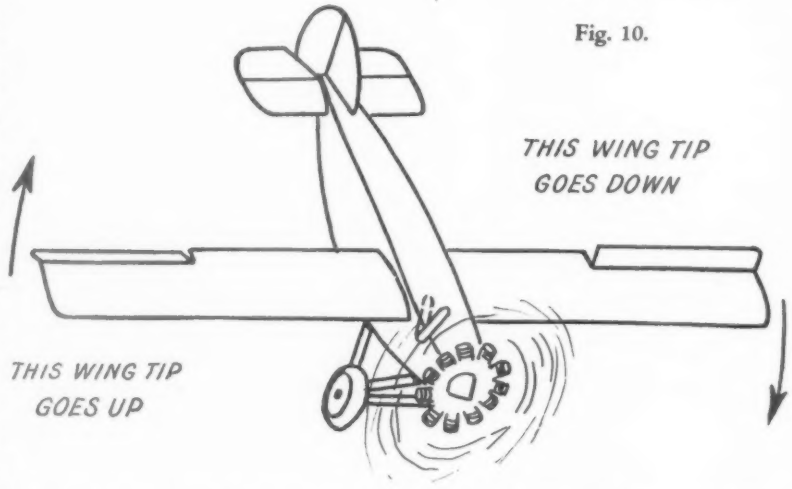
Turning about the longitudinal axis XX is termed rolling.

Turning about the vertical axis ZZ is termed yawing.

When the airplane is banked steeply, the functions of the controls apparently get confused: the rudder may raise or depress the nose relative to the earth's horizon, the elevator may be turning the plane in a circle. The so-called inversion of the controls is only apparent. The action of the controls about the three axes of the airplane always remains the same.

It is very important to remember this when considering the maneuvers of airplane and the functioning of the controls in the various positions of the airplane.

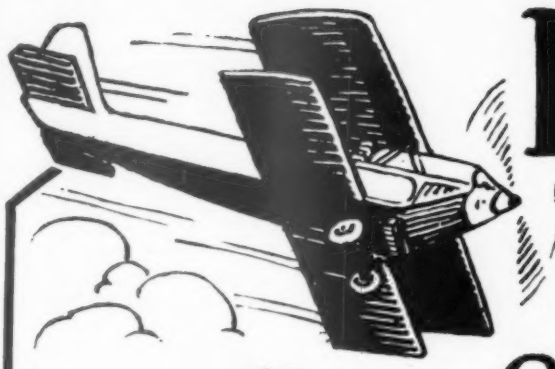
Fig. 10.



Problems

1. A pilot banks his plane, weighing 2,100 pounds, at a speed of 100 miles an hour. The angle of bank is 60 degrees.
   a. What is the centrifugal force exerted on the plane?
   b. What is the lift on the wings?
   c. What is the radius of turn?
   d. What is the angle of attack if the wing section is a Clark Y, and the wing area 300 square feet?
   e. What would be the speed of the plane in straightaway flight at same angle of attack?
   f. What would be the angle of attack if the speed on straightaway were 100 miles an hour as on the turn?
   g. What is the power required for the wing on the turn and on straightaway flight at 100 miles? What is the power required at the speed?
2. A plane is cruising at 80 miles an hour, when the pilot pushes the stick to the right. What happens if the speed of the plane remains the same?
3. The pilot pushes the left end of the rudder bar forward; all other controls neutral. What happens?

(Continued on page 84)



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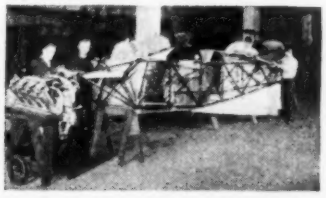
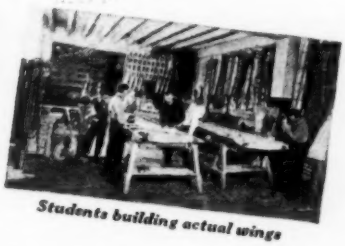


Factory engineer explaining construction of engine carrying frame



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Washington and Aeronautics

(Continued from page 73)

The new Secretary, James W. Good, has not declared himself, but since the General Staff has endorsed that policy it is likely that Secretary Good will embrace the idea.

Representative Furlow, of Minnesota, championed the air corps promotion bill in the last Congress and is expected to do so again. Army aviators are encouraged by the fact that the new chairman of the Military Affairs Committee in the present Congress will be Representative James, of Michigan—the man who fathered the five-year aircraft program and won its adoption.

The Air Commerce Act of 1926, giving the Department of Commerce regulatory powers and the duty of providing aids to air navigation, has been an immeasurable boon to the infant industry. In fact, regulation almost has been the life of the trade. Federal inspection of aircraft and licensing of pilots have given confidence to the public which is anxious to fly but wants some official assurance of safety to overcome a lingering fear of air travel.

A highly organized, smoothly functioning staff of aeronautical specialists has been created in the Department of Commerce under the Assistant Secretary for Aeronautics. Congress has given this branch for the coming year about five and a half million dollars to provide aids to air navigation. A considerable increase probably will be asked for next year to take care of the rapidly growing demands which the civil aeronautics industry is making.

A large portion of present funds are being spent for towers and beacons. This is a tangible service and its results can be seen. There is less appreciation of the unspectacular and unromantic services of testing aircraft and issuing driver's permits to pilots who aspire to enter the aviation profession.

In the last session of Congress the Bingham bill was passed which gives the Department of Commerce the power to rate flying schools. Schools by the score are turning out graduates who seek to engage in professional flying. Some measure of control was thought necessary in order to encourage the maintenance of schools that give courses of training that can be depended upon to produce thoroughly competent pilots.

Washington officials also are concerned about state aviation laws and regulations. Thus the Department of Commerce has recommended adoption by states of a uniform law respecting licensing of intra-state flyers, many of whom are now unlicensed and not subject to inspection. The objective is to secure state legislation that will recognize federal licensing and inspection, thus doing away with duplication in the states and avoiding confusion through the adoption of regulations for state flying at variance with the Commerce Department's requirements for interstate flying.

The Bureau of Lighthouses with its long experience in lighting the courses of ships at sea has been called on for lighting the trans-continental airways so that planes can fly by night as well as by day. Even the Department of Agriculture whose chief official concern is to help farmers with their crops, now is a vital factor in aeronautics through its Weather Bureau which virtually gives pilots the stop and go signals through its hourly forecasts of rain and sun.

Popular Aerial Photography

(Continued from page 54)

tive to all colors. When used with the proper filter this is the best for ordinary aerial photography. All colors in the scene below will receive equal representation in the picture and the result is a clearness and brilliancy which can be obtained in no other way.

For very particular aerial photography under exacting conditions there is now the hypersensitized panchromatic film which when used with a minus blue or a red filter is the last word, at present, in sensitive material for the aerial photographer. This is the film with which most of the best aerial photographs are made. It is the film which I used in the Fairchild Aerial camera while on active military duty at Chanute Field. Unfortunately, this type of film is not, as yet, supplied for amateur cameras. Therefore, the average amateur aerial photographer will have to use orthochromatic or panchromatic plates or films with the correct filters for the type of picture he wishes to make and the light-conditions he is compelled to meet.

Under favorable weather-conditions the orthochromatic plate or film with a light yellow filter will produce very satisfactory results; and that is probably what most of my readers will use. I have had good luck without a filter when conditions were right; but I believe a filter helps to make a good picture better.

The question of exposure is vitally important. It depends upon elevation, speed of plane, type of filter used, speed of lens, and sensitiveness of plate or film used. Although I am a believer in exposure meters on the ground, it is another matter to make a reading or a calculation with them in the air. To be sure, in a cabin ship there should be no great difficulty unless, with some kinds, the vibration might make an accurate reading out of the question. The Burroughs Wellcome & Company's "Exposure Calculator" supplies a very helpful little table on aerial exposures which I believe my readers will find of value. Obviously, the table must be used intelligently in connection with the particular situation in which the amateur aerial photographer finds himself. If nothing more, it is a reliable guide which the individual should learn to apply to his own exposure-problems.

I am indebted to Burroughs Wellcome & Company for the use of the following table:

EXPOSURES FOR AERIAL PHOTOGRAPHY

Minimum Shutter—Speeds permissible for sharp results

Height above ground	Actual speed of machine, miles per hour					
	50	70	90	100	110	120
1000 ft.	1/200	1/280	1/360	1/400	1/440	1/480
2000 ft.	1/100	1/140	1/180	1/200	1/220	1/240
3000 ft.	1/80	1/80	1/120	1/130	1/140	1/160
4000 ft.	1/80	1/80	1/90	1/100	1/110	1/120
5000 ft. and over	1/80	1/80	1/80	1/80	1/100	1/100

This table is for vertical photographs and for lenses of not more than 8 in. in focal length.

For oblique photographs, shutter-speeds must be increased according to angle from 2 to 3 times.

For longer focus lenses, calculate as follows from table—Height 3000 ft., Speed 100 miles per hour, lens 8 in. = 1/130 sec. 1/130 × 12/8 = 1/195 for 12 in. lens.

NOTE.—When using a filter, the increase in exposure demanded by the combination of filter and plate must be allowed for.

I hope I shall be pardoned if I refer directly to certain cameras which I know may be used in the air with greater or less chances of success. The omission of any camera does not imply that it is unsatisfactory. I am mentioning only those of which I have personal knowledge as having been used successfully in the air in open cockpit planes. As already stated such cameras as the Folmer Aero Model A-1 and Model K-5, the Fairchild Aerial cameras and a host of British, French and German aerial cameras are hardly to be considered here because of their cost and comparatively intricate manipulation. Those who can afford them and will master them will have the latest and best in aerial photography. I might add that the Folmer Aero Model A-1 is not beyond the means or photographic

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Aircraft Float Design

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Airplane Stress Analysis

by Alexander Klemin, *Prof. of Aeronautical Engrg., Daniel Guggenheim School of Aeronautics, N. Y. University.* **277 pages, 105 illustrations, Price $7.00**

Shows, step by step, how to make all the calculations in the airplane stress analysis required by the Department of Commerce. Each point is explained with the utmost clearness and simplicity; advanced mathematics has been avoided so far as possible. Explains the principles of applied mechanics involved and develops the formulas that furnish the foundation for stress calculations. Takes as an illustration an airplane of average characteristics and gives full examples of all the computations required. Supplies in concise, easily usable form, all the data on materials of airplane construction to which the calculator must frequently refer.

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Airports and Airways

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Practical Flying

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Aeronautical Meteorology

by Willis Ray Gregg, *Senior Meteorologist in Charge of Aerological Division, United States Weather Bureau.* **144 pages, 44 illustrations, Price $2.50**

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ability of a large number of advanced amateurs. It is a real aerial camera at a comparatively moderate price.

Now to mention amateur and some professional ground cameras which have done creditable work in the air. I have stated that I have no knowledge of a box camera of the Brownie type being used in the air, although I can conceive of conditions when pictures might be obtained with it. Vest-pocket and pocket cameras of the Kodak type in a number of makes such as Kodak, Agfa-Ansco, Voigtländer, Ernemann, Goerz, Ica, Glunz, Kawee, Igento and others will make fair pictures in the air provided they are protected and the particular models used are equipped with maximum shutter speeds of 1/200 or 1/300 of a second and lenses whose maximum opening is not less than F/7.7, preferably F/6.3 or F/4.5. Also, when possible, panchromatic plates or films and suitable filters should be used.

Focal-Plane Cameras

We next have the focal-plane cameras of the Graflex type which are to be found in many of the makes already mentioned. There is ample shutter-speed and, usually, the lenses supplied as standard equipment are F/4.5 or faster. For the best results with a ground camera of fair picture size I believe that the Graflex type will be found very satisfactory when used with the correct plates, films and filters.

We now come to the little cameras which are still cameras but use motion-picture film. These are the Leitz "Leica," the Agfa-Ansco "Memo" and the new Q. R. S. "Kamra." Being box shaped, that is, self contained in a sturdy metal or wood case and small in size they are easily handled and the little pictures they make are wonderfully clear and sharp so that enlargements of considerable size may be made from the negatives.

Movie Cameras

And now, just a word about the amateur movie cameras which have made good in the air, the Ciné-Kodak, Bell & Howell "Filmo," Victor, Q. R. S., Ica, Pathex and a number of foreign makes. The DeVry, standard movie size, has been used by many amateurs with great success because of its self-contained box-like construction. The equipment mentioned may be examined in most of the leading photographic stores, and further details may be obtained regarding each type and make.

In conclusion, let me say that there is much that remains to be said with regard to equipment and technique. Doubtless, I have omitted a number of things which I should have included; but in trying to avoid technicalities and to make this article as informal as possible, it was not possible to avoid some errors of omission and commission. There are still questions which remain unanswered. These, with the indulgence of the editor, I shall be glad to try to answer in a future article or by mail if he will forward the inquiries to me.

In closing, let me remind my readers that in the air protection of the camera from the wind is essential; that the camera should be held as free and clear as possible from the sides of the ship to avoid blur due to vibration; that a system of signals should be agreed upon with the pilot before leaving the ground; that aerial photographs with amateur ground cameras should be attempted only under favorable conditions of light and weather and that intelligent thought should be given to the matter of exposure, sensitive material, filters, lens-openings, shutter speeds and getting the "feel" of the camera in the air.

The first pictures may or may not be satisfactory; but persistence, study and attention to details will bring success. There is a new and beautiful world calling to the amateur and the professional photographer, and it is my sincere wish that those who soar aloft will reveal its wonders to themselves and to others through aerial photography. Given the eyes to see and the heart to understand, it can be done.

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KINNEAR ROLLING · DOORS

The Truth About Nobile's Rescue

By Captain Einar Lundborg

(Continued from page 18)

Ceccioni had been brought to the ice field during my absence. They were all sorry for what had happened and they could not find words strong enough to express their regret at the accident.

The next day we began to move the camp over to the landing field, but it took a very long time to bring over all our things. At last we were finished and erected the tent right under the tail of the plane.

During the days that followed, our food consisted of pemmican, cocoa, dog biscuits and condensed milk, dropped on the ice by Italian and Swedish planes. We also had cigarettes and the remains of a polar bear which Dr. Finn Malmgren had shot before he started out on what proved to be his last journey.

During this time we were able to send out radio messages, although we were frequently handicapped by atmospheric disturbances. We were promised both flying aid and help from ice breakers, but as the fog would not give way and no vessel was sighted, we lost courage.

On the 5th day of July, after a period of mist and heavy storm, the sun peeped out and we spent the whole day in the open to dry. But as no machines came in spite of repeated promises, our nerves became exhausted by the monotony of the food and the hopelessness of the situation, and our conversations were no longer carried on in a friendly tone.

But that night rescue came at last. In the early afternoon, a Swedish machine flew over the camp and threw down a number of necessities, but as it had pontoons and could not land near us, despair entered our hearts again. Only an hour later, however, the Swedish tri-motored "Uppland" swept low over the ice and dropped more packages, among which I found my knapsack containing all kinds of good things: newspapers which had come by airplane from Sweden and finally a statement that a light sport machine with my observer, Lieutenant Birger Schyberg, as pilot would come over to us the following night.

Dusk settled, but no machine was seen. I almost began to despair when, at half past one, two dark spots appeared over the glacier of the Northeast Land, and a few minutes later Lieutenant Schyberg made a perfect landing on the uneven ice field, according to the directions which I had laid out.

He had orders to take me on board first, and it certainly felt fine in a way, but it was also difficult to see my comrades left behind out there, for they indeed had been there a whole month longer than I.

I hurried up into the machine and soon the little Cirrus engine began to whirr and not many moments later we were in the air. The idea from the first was to continue the work of rescue, but as Lieutenant Schyberg was exhausted from his gallant flight and as I was not allowed to fly the machine, and as finally the fog returned, the rescue flights stopped with this one venture. When I finally got on board the "Quest" I received both food and drink, sleep and clean clothes and it wasn't easy for my

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NEXT MONTH

General Mitchell writes on Air Power—the Determining Factor in the Next War

July issue of Aeronautics is on sale June 25.

comrades to recognize in me the dirty and unshaven fellow from the day before.

Not long afterwards I was immensely cheered to learn that the Russian ice breaker, "Krassin," had rescued Zappi and Mariano on July 12, and that on the same day it had brought my comrades from the Italian camp to safety. It was wonderful work that the "Krassin" had performed and we all admired the courage and the perseverance which the Russians had shown. But the joy among us Swedes was not complete.

One of our men was lacking in the circle: Dr. Finn Malmgren, who had died among the masses of eternal ice. He had fallen like a soldier of science, he had performed a great work and his memory will live forever.

In the middle of July the Swedish expedition was ordered home. On the way south we stayed a few days in King's Bay to wait for the "Krassin," which had taken my Fokker machine on board.

While returning from Spitzbergen, I, like so many others, had several times asserted that this Arctic group of islands was the last spot on earth where I again would direct my journey, but once safely back in Sweden, a longing came over me to see once more the place which was the scene of the most remarkable adventure of my life.

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Answers to Aerodynamics Problems

(Continued from page 76)

1. a. 3,640 lbs.
   b. 4,200 lbs.
   c. 385 feet
   d. 2 degrees
   e. 70.7 miles per hour
   f. —1¾ degrees
   g. 56 horsepower
      35 horsepower
      19.9 horsepower

2. As the pilot moves the stick to the right, he depresses the left aileron and raises the right aileron; therefore there is more lift on the left wing than on the right. The right wing drops, and the plane makes a right bank. Since the speed in the bank is the same as in level flight, the nose of the plane drops a little.

3. As the left end of the rudder bar moves forward, the nose of the plane moves toward the left since the rudder is deflected and the force on it moves the tail of the plane toward the right. If the rudder is moved suddenly or deflected very much while the plane is in level flight the plane will "skid" since there is no horizontal component of the lift to counteract or work against the centrifugal force. See Fig. 2 for the forces acting on a plane in a bank.

Monthly Financial Review

(Continued from page 47)

tion, Ltd., International Airways of Canada, Ltd., and Canadian Airways, Ltd. Each one of these companies will maintain its separate identity and it is, therefore, presumed that the purpose of the merger was largely taken as a step to assure continued Canadian control of these companies.

Earnings, Statements and Miscellaneous Financial Items

The Keystone Aircraft Company in their report for the year ended December 31, 1928, showed earnings of $2.28 per share on 287,000 shares of no par Common Stock.

The Western Air Express has put their new stock on a 15¢ quarterly dividend basis which seems low in view of the earnings of $6.73 per share which the company reported for the year. However, directors have taken the conservative view that this is as much as they can afford to pay with the proposed Salt Lake-Kansas City route still to be established this year.

The Pratt & Whitney Aircraft Company, a subsidiary of the United Aircraft & Transport Corporation, showed net earnings for the first quarter of 1929 of $1,300,000, in comparison with net earnings of $337,000 for the corresponding period in 1928. This is the only United subsidiary as yet to make a report this year and argues extremely well for the parent company, as the Pratt & Whitney earnings alone for the quarter represent approximately 73c a share on the Common Stock of the United Company.

The Aero Supply Manufacturing Company, Inc., has increased its authorized Class B Stock from 65,000 to 500,000 shares. The plan of reorganization will provide for the exchange of one share of old Class B for three shares of the new stock and the present outstanding Class A Stock will be convertible into the new Class B at the rate of three shares of new Class B for each share of Class A. Holders of both classes of present A and B stocks have been offered rights to subscribe for one share of the new Class B Stock at $9 per share for each share held. The company has also arranged for the purchase of the Standard Automatic Products Company and the National Steel Products Company, both small manufacturers of aeronautical supplies, through exchange of 200,000 shares of the new Class B Stock for the stocks of the companies mentioned.

The Kinner Airplane & Motor Company's recapitalization plan, which was offered during the month, was protested by a group of minority stockholders and has since been abandoned. A new plan will probably be substituted within the next few weeks which will be satisfactory to minority shareholders, but details are not available as yet.

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Where Does Weather Come From?

(Continued from page 23)

the prevailing winds are westerlies in the latitudes of this country.

The heated air over the Southwestern Desert is pushed upward by the colder and heavier air. The air over the Pacific Ocean is driven eastward. As it reaches the Sierra Nevada range it is deflected upward. To pass over these regions it must rise to altitudes as great as two miles or more. Here it is cooled by the cold earth and by mixing with colder air. At its new colder temperature it can contain only a fraction of the water-vapor which it gathered over the Pacific. Rain and snow fall upon the mountains and little moisture is left when the desert is reached—hence the desert.

Many persons are familiar with the more or less brisk breezes which blow landward from the sea in the daytime, at least during the summer months. This breeze is due to temperature-difference and is a sort of "daily monsoon." This effect is also noticeable along lakes of reasonable size. On a hot summer morning it is not uncommon to see clouds gently floating shoreward. If one watches with an observing eye and an attentive mind, he may note that this cloud as it reaches the shore line is suddenly pushed upward. Sometimes it is violently torn by the rapidly rising air heated at the hot sandy beach. To the air-minded, one sees here the prospect of a sizeable "bump." In fact, there is a bumpy region along this shore line.

In the winter this large lake is warmer than the snow-covered frozen land adjoining it. Furthermore, the air over the water is quite saturated with water-vapor and being warmer it rises. Striking the colder air it condenses and we have the cloudiness so characteristic of certain regions in the winter.

In any region where a warm wind comes in contact with the relatively cold wind from higher altitudes the pressure gradient usually becomes steeper. This "slope" of this pressure gradient is like the steepness of a decline in the case of running water. As a consequence there is a sudden increase in the velocity of the wind and often there is a vigorous shower of rain commonly called the "clearing shower."

In a similar way squalls are accounted for by the mixing of air currents of different temperatures e i t h e r near the earth's surface or in an upper region of the atmosphere. Sometimes the two meeting currents are at different levels and their conjunction may be caused by convection (vertical) currents. The effect of this vertical motion when it is transferred to the earth's surface may result in a water-spout and even a tornado.

Squalls—winds rising suddenly, blowing strongly for a short time, and dying away suddenly—are traceable to similar conditions. The squall associated with the thunderstorm, which can be observed by the rolling cloud preceding the storm, is caused by a cold outrushing wind meeting the warmer quieter air.

A general or prevailing wind is deformed and even interrupted by many horizontal winds of varied strength and velocity. Besides these, there are the common convection currents which are due to local heating of the earth's surface. From the latter the cumulus clouds are born in fair weather.

One may actually observe these clouds being formed on a summer morning. In an hour or so there may be many of these gently floating. The moisture-laden air which has become heated by the warm surface showered with sunshine is pushed upward by the flowing downward or in-

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XUM

ward of cooler air. Black earth absorbs more solar energy than a green pasture or a wheat field. Thus air rises from it more rapidly than from these other areas.

A body of water absorbs most of the solar radiation but the surface does not become as hot as sand or earth because it is cooled by conduction to and by mixture with lower layers of water. Therefore, everywhere we have different degrees of local heating which give rise to atmosphere movements which result in weather of many kinds.

As one mounts upward in an airplane into the cloud region he sees some of the mechanism of meteorology. He sees the crests of fair-weather cumulus clouds in the neighborhood of a mile in altitude. He may note that these crests are lower in winter than in summer—perhaps one or two thousand feet lower depending upon the locality. As he reaches the level of these crests he notes that he is at the surface of a sea of haze.

Where does this haze come from and what does it mean?

If he knows the extreme importance and foundational nature of temperature-difference, he recognizes that this is the upper limit of diurnal or daily vertical disturbances of the atmosphere. He knows that this is the practical limit of bumpiness ordinarily.

It is true that there are definite general movements of the atmosphere above this altitude and that there are also local disturbances including upward convection currents still higher. The fact that he encounters clouds at still higher altitudes up to six and seven miles is evidence that upward movements of air continue to these heights. This is true because clouds are condensed water-vapor and the air initially obtains all its water-vapor by evaporation at the earth's surface.

The diagrams accompanying this article should be helpful to the reader in visualizing the general circulation of the winds which are at the foundation of weather. They also are of particular interest to the air-minded because they show the general course and strength of air-currents across the oceans and at low and high altitudes.

An inspection of these diagrams shows why the west-east flyers have done better than the east-west flyers over the North Atlantic. They show that a trip from Spain to South America has the advantage of tail-winds—the brisk, northeast trades. They show the uncertainties of the winds in the equatorial doldrum belt and the Horse latitudes. Over the continents the direction and strength of winds are influenced by mountains and other local factors absent over the level oceans.

It is interesting to visualize the direction of travel of the great cyclonic storms in terms of the general circulation of the atmosphere. By consulting daily weather-maps with this foundational background in mind the air-traveler and others may gradually acquire a sound knowledge of winds and weather.

Certainly even this brief discussion indicates that temperature-difference is the fundamental cause of weather. Of course, it is equally true that the earth's gravitational force is the real basic cause. But this is carrying the analysis beyond reason, because we take this gravitational force for granted just as we do the earth. Without this characteristic force we would have no earth.

There are many secondary influences which follow temperature-difference in making weather, particularly for small localities, but in the main, temperature-difference is the basis of meteorology. Also to the flyer it is the foundation of bumpiness excepting for those bumpy conditions close to the earth's surface which are due to topography of the terrain and to winds deflected by buildings.

Every aspect of winds, weather, and climate is of interest to aerial travelers. In fact, their interest in the aerial world even extends outside the older science of meteorology which must be extended to meet the new requirements.

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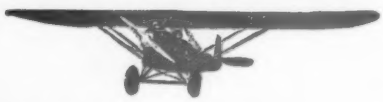

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Business Says "You Must Fly"—

(Continued from page 32)

sembly will continue to be effected by hand.

Aviation as an industry will develop more rapidly than the automobile industry. The airplane distributor fortunately can earn money with his demonstrator, whereas the automobile demonstrator represents in a sense a loss.

Money invested in an airplane demonstrator should be returned to the dealer through the various methods mentioned. While the manufacturer would appreciate a condition permitting dealers to devote all their time and energies to selling planes, he realizes economics of distribution do not permit.

There is profit to be made in the aviation industry as in older established business and the same fundamental consideration applies: proper management. Today's aviation management is largely untrained. Most companies to date, with outstanding and successful exceptions, have failed to make a substantial profit because their managers have been too visionary. The companies have been directed by individuals with pronounced ideas concerning plane construction. If the ideas proved feasible, the planes sold.

Of course the Lindbergh flight made it possible for airplane manufacturers to reap financial rewards. Almost overnight, people became air conscious. That flight created a great demand for planes. But did the companies derive those profits?

Take our own case. I checked through our payrolls recently with our factory manager. I was surprised to learn that last September and October we had practically as many men working in the shop with as high a payroll as today and we were turning out less than one-third our present monthly schedule of planes. Why? Because no two planes were alike. One purchaser wanted a plane with a 250-gallon-capacity gasoline tank, and the next desired a plane with a 100-gallon tank. One wanted the tank in front of the cockpit, the other behind. Then we woke up. We standardized production. We now do not permit ourselves to be swayed too much by individual orders.

Airplane costs seem high today. No business firm wants to pay $12,000 for a plane when it can purchase a fine automobile for $4,000. Yet airplane prices represent a legitimate profit only when the manufacturing company knows its costs and applies efficient principles of management. And the airplane user will find the plane cost lower when he balances the time saved for his executives and salesmen against time consumed by "ordinary travel."

By publishing and broadcasting accurate statistics as to the low rate of fatalities in aviation, the industry can speed up adoption of the airplane by business. It costs in the neighborhood of $30 per air hour to own and operate with pilot a standard five-passenger closed airplane. In three hours flying time such a plane can carry four executives around a 300-mile circle and have them at home for dinner, with as many stops meanwhile as the party wishes to make.

I venture to state that business will adopt the airplane as rapidly as its leaders assure themselves of its potentialities.

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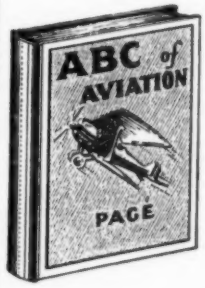

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Books of the Month

OF paramount interest among the books appearing in the field of aeronautics during the past month is the Aircraft Yearbook for 1929, issued by the Aeronautical Chamber of Commerce. This publication, which is now making its appearance for the eleventh consecutive year, possesses much of the fascination that attaches to a college annual. It is a record of sound accomplishment, and what is perhaps almost more stimulating, of definite progress.

As a reference work the Aircraft Yearbook holds a unique place. The editorial office of an aeronautical magazine provides unexcelled clinical facilities for the testing of any reference book, and certainly no book is more useful, day by day, than the Aircraft Yearbook. The 1929 edition contains the most comprehensive and accurate record of American aeronautical activity for the year just closed which can be obtained in a single volume anywhere. The statistics are reliable since they are practically all secured from official sources, and the presentation is well-proportioned and commendably free from the ballyhoo tendencies sometimes incident to aviation publicity.

The Aircraft Yearbook will have a general distribution among the members of the aeronautical industry as a matter of course, but its utility as a concentrated and strictly impartial account of contemporary American aviation should recommend it for a much broader circulation. People everywhere in need of exact information on the status or history of almost any phase of aviation will find the Aircraft Yearbook a valuable book.

AIR navigation is not a highly complicated matter, but text-books explaining it very often are. This misrepresentation of the facts is doubly unfortunate because, besides making the work of the student unnecessarily difficult, it may result in giving him a permanent distaste for the whole subject. Solving an ordinary problem in air navigation involves a minimum of mathematical computation and requires about the same degree of cleverness demanded by a cross-word puzzle.

"Avigation by Dead Reckoning," a book just published by the David McKay Company of Philadelphia, the work of Captain Ienar E. Elm, presents the topic of air navigation with great intelligence. The chief obstacles in the path of clarity, so far as most books on this subject are concerned, appear to be in the first place the desire of the writer to take for granted a certain familiarity on the part of the reader with compasses, charts, and the slight technical vocabulary necessary, and in the second place bad organization of that material is presented. Captain Elm's book is self-contained and well organized, and accordingly is a valuable addition to the available fund of material on avigation.

Aircraft Yearbook, 1929. Pub. by the Aeronautical Chamber of Commerce of America, Inc., New York, 484 pp. Illus. Price, $5.25.

Avigation by Dead Reckoning, by Captain Ienar E. Elm. Pub. by David McKay Company, Philadelphia, 1929. 120 pp. Illus. Price, $2.00.

Airplane Transportation. Pub. by the Hartwell Publishing Corporation, Hollywood, 1929. 353 pp.

The simplest possible method of approach to the subject is used by Captain Elm. After a brief explanatory introduction, the book describes the magnetic compass, the earth inductor compass, and the radio beacon. The following chapters discuss successively true courses, magnetic courses, the relation between true and magnetic courses, compass courses, the relation between magnetic and compass courses, the relation between true and compass courses, plotting the course with allowance for wind and finding the ground speed, convenient trigonometric laws, finding wind direction and velocity, finding track and ground speed, radius of flight in a given direction, bearings, instruments, adjusting the compass, and developing proficiency.

In connection with the chapters dealing with application of corrections to courses a large number of problems are given, and the answers are assembled together in a convenient group at the back of the book. There is thus an opportunity for the student to make a practical test of his mastery of each stage of the training as it is presented.

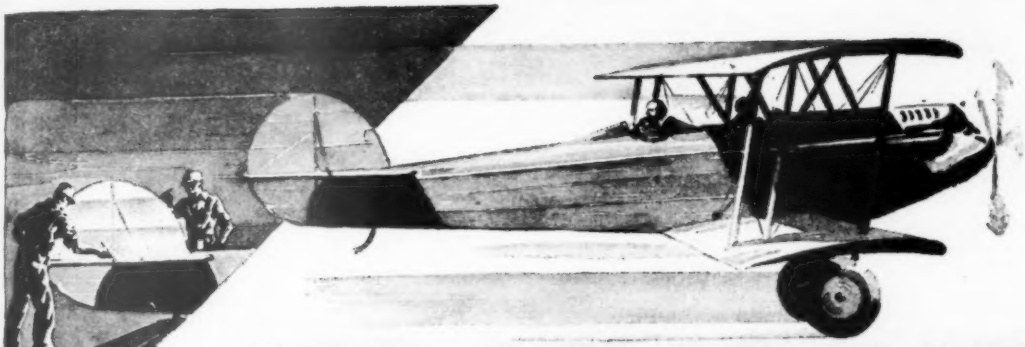
AT the beginning of the school year in 1927 the University of Southern California offered, through its University College, a non-technical evening course on airplane transportation. The success of the course was so marked in the first three quarters in which it was offered that the following year the University decided to offer it on campus, in connection with the College of Commerce and Business Administration. A record enrollment was attracted and the course now ranks as one of the most popular on the entire University schedule.

This course, which was at the beginning simply a series of lectures and talks by experts in the field, has now found expression in book form under the title Airplane Transportation. The authors are James G. Woolley, Vice-President in Charge of Traffic of the Western Air Express, and Earl W. Hill, Lecturer in Trade and Transportation in the University of Southern California. The book is intended primarily perhaps for persons not possessing unusual familiarity with aeronautics. In this capacity it should be of interest to anyone anxious to secure a well-rounded idea of the issues in aviation. Practically every phase of the topic receives attention in this book. The point of view implied by the title is maintained fairly steadily throughout, but there are chapters on the theory of flight, on the training of personnel, on the operation of planes, on airways, and on the different types of equipment available for what the British nation sometimes refers to as "jobs of work."

Very interesting data is contained in the chapters on commercial application of aircraft, and on investment and speculation in the field of aviation.

The importance of making a thorough-going analysis of aviation offerings before actually indulging in the purchase of stock is emphasized, and in view of the probable limited familiarity with matters aeronautical of most of the people whom the book will reach, this word of caution is well spoken.

This book, which comes to AERONAUTICS with the compliments of the Fokker Aircraft Corporation of America, is significant as one of the first attempts on the part of any great educational institution to recognize the very broad importance of aviation as a factor in the satisfaction of human needs. Technical interest in the purely scientific aspect of flying has long enjoyed academic status. It has remained for the University of Southern California, appropriately situated as it is in the heart of one of the most air-going portions of the United States, to point the way to a new attention and respect which must be accorded aviation in consideration of the part it is already undertaking in carrying the world's trade.



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The Collapse of the Coolidge Air Policy

By General William Mitchell

(Continued from page 15)

in Asia and South America where we could not only sell aircraft but where the influence and friendliness caused by air power would result in great advantage to our country, both commercially and in a military way. These recommendations were not carried out, largely on account of the opposition of the Army and Navy, with the result that the Europeans have obtained the upper hand in most of these countries.

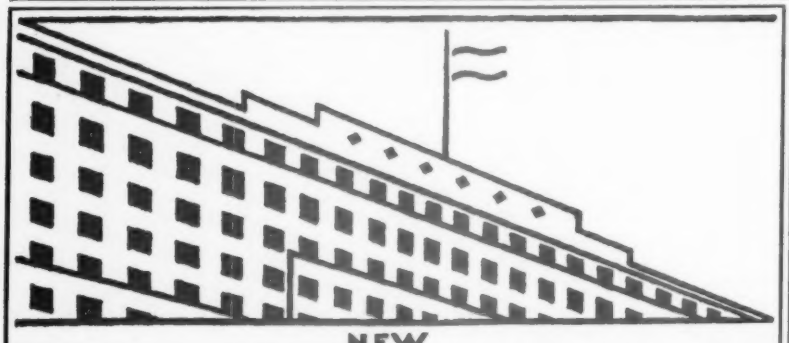
The third section of the air department, charged with the care of military aviation, would have as its particular duty the defense of all the air areas over and around the United States. Its job would be to attack from the air any place in the world, whenever necessary, to sink any ship in the sea, and to prevent hostile aircraft from flying over or attacking the United States. By this system there would be one air force working together for the defense of the country. All air preparations would be lumped under one head. There would be no separate overheads for the Army and Navy, the Marines, the Coast Guard and others. More than anything else, this air force would be developed under real air officers.

A man put through West Point, for instance, and then assigned to the Army before he goes to the Air Force, thinks first of the infantry on the ground and then of an airplane. He thinks of the airplane as protecting the infantry. He does not think of it primarily as attacking an enemy two or three thousand miles away from the infantry. The whole mental attitude of one brought up in such a service is to restrict the powers of aircraft.

With the Navy, it is even worse. The naval officers think first of the battleship, and their ideas are to make airplanes to defend it; but this great big logy metal melon can be cracked and sunk with the greatest ease by aircraft. In fact, battleships, as at present constructed, have become so topheavy and useless that if they get a good crack below the water line, they just turn over and sink of their own accord. They are just as useless when put against aircraft as the old knights in the Middle Ages were, with their heavy armor, when attacked by a man with a musket.

President Coolidge was told of the conditions that faced the development of aviation in this country, and at first it looked as though he would assist in developing it in a broad manner. But as he is before everything else a politician, he determined that he could get more influence from the large moneyed interests that work hand in hand with the Navy Department than he could from the small and struggling group developing aviation in this country. He was afraid of the influence of the personnel of the services of the Army and Navy, if any new departure should be made in existing conditions. With the appointment of the three new undersecretaries in the War, Navy and Commerce Departments, a great cry was made all over the country through Coolidge's controlled press that air power was being assisted and developed. Nothing of the kind was done, as it was still made the tail of the dog. It was not given a separate department in the Government under a cabinet member. This must be done eventually, so the sooner we create it the better.

The chaining of American aviation by Coolidge to the Navy, Army and Commerce Departments is a calamity and I hope that in the interest, not only of aviation but of the whole future of the United States, the Hoover administration will not continue Coolidge's ruinous policy.



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Model Builders' Department

By Bertram Pond

Morris Hydro Model

THIS machine broke the former world's hydro record with the astonishing time of 12 minutes and 30 seconds. It was built by a 16 year old lad who had been building models for just slightly over one year. See what can be done if you get started correctly in model airplane work!

This official hydro record was made at the Atlantic City National Contest of the National Playground and Recreation Association of America.

In the following description we will attempt to show you how really simple a world's record model can be in construction for there is nothing complicated in the process as you will find by building the model yourself. You will find several new ideas or "inventions" in model construction in Mr. Morris' machine.

The model rose off the water of a small artificial pool constructed by the Atlantic City fire department at Bader Flying Field and quickly climbed to a very great altitude, so high in fact that it was almost out of sight. After reaching its highest point it leveled out for the long glide which added six or eight minutes to the total time of the flight. It glided across the city and across the board walk and finally landed out on the surf of the Atlantic Ocean. A pair of binoculars was required to be able to see it land.

The coast guard was summoned and after an hour's search the machine was finally recovered. Because of Mr. Morris' careful water proofing, the model was intact and ready to fly again.

The model flew so long and so far because it had a large rubber weight to total weight ratio and the rubber was properly used. The model also was set at its highest climbing angle without stalling.

The design of this model was arrived at by studying previous prize winning and record models with the addition of the latest ideas in the construction of twin pushers.

Only the best materials were used. All of the metal fittings were proportioned for their load but all possible weight was eliminated in their design.

You will need the following materials to build this machine correctly.

2 1/16"x1"x2¾" balsa veneer for float former.
1 1/16"x1½"x3½" balsa veneer for rear float.
2 ⅝"x1¼"x12" balsa for propellers (or 2 carved propellers, 12" diameter).
4 ⅛"x¼"x12" balsa for wing beams.
2 3/16"x⅜"x40" balsa motor bases.
2 3½"x1"x1/16" balsa for elevator tips.
2 Special bamboo pieces for curved bamboo parts.
3 15" bamboo for rear X braces, front frame braces, ribs, elevator and float struts.
4 Washers, hard brass, special light type.
2 Special light steel drilled thrust bearings.
1 Piece No. 6, .016 rust proof music wire 12" long.
1 Piece No. 11, .1026 rust proof music wire, 24" long.
1 Piece No. 14, .1033 rust proof music wire, 24" long.
Or one set of ready formed wire parts.
2 1/32"x⅛" rubber motors—33 ft strips.
1 Sheet 21"x31" Japanese tissue.
1 Piece small socket tube.
1 1 oz. bottle of paper cement.
1 2 oz. bottle of light dope.
1 2 oz. can of ambroid cement.
1 1 oz. bottle of hydro dope.

Tools

You will need only ordinary tools such as a sharp knife, ruler, sandpaper, pins, paint brush, razor blades, small round nose and cutting pliers.

Construction

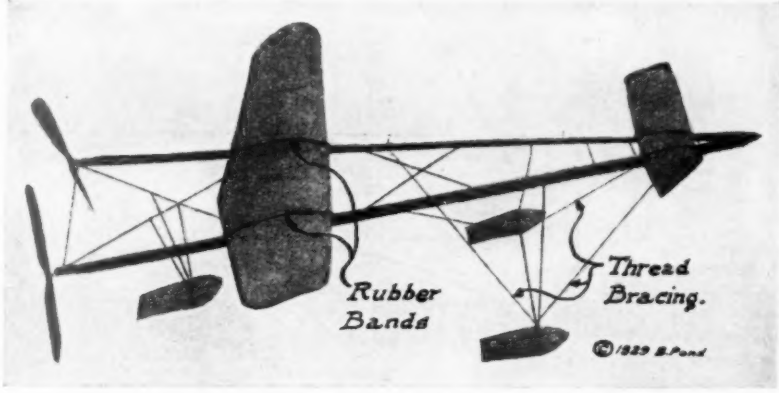
Study the drawings and descriptions very carefully before beginning the construction. We will take up the construction of the frame, wings, propellers and floats.

Frame

The motor base sticks are slightly rounded by sandpapering. Lay the two motor sticks side by side so that the ends are even and mark the locations of the "cans" and "X" bracing with a pencil. Point the rear ends of the sticks so that they taper towards the center. See the drawing. The front ends of the sticks should be cut at an angle so that when these two angular sides are held together the rear ends of the spars will be exactly 11½" apart. Dope the sticks all over with paper cement or thick banana oil. Dip both ends of the two sticks in ambroid about ½" deep and allow the ambroid to dry. Wet the front end of the sticks again with ambroid and pin them together checking the distance between the rear ends of them again. Make the wire yoke or front hook as shown in the drawing and slip this over the front. Ambroid this yoke securely in place with two coats of ambroid allowed to dry thoroughly between each coat. When the ambroid is fully dry on the nose you can assemble the bamboo braces.

Make the braces to the size shown in the drawing rounding the edges.

With the sharp point of your knife pierce the inside of the beams along the center line as shown in the drawing at the locations for the braces. Be very careful that you do not mistake the "cans" locations for the bamboo bracing marks on your spars. Point the bamboo pieces and stick them through their proper slits in the beams so that they will be just flush with the



outside surface on one spar and the extra length will project beyond the outside of the other frame spar. This will save you from cutting off both ends of the bamboo pieces and simplify the alignment of the frame which can be done all on one side. Slide these extended bamboo pieces back and forth in the slots until the frame members are truly lined up. This can be checked by sighting down the sticks from the front end. Be sure that the rear is 11½" apart when you are done lining up the frame. Ambroid the inside junctions of the beams with the bamboo very carefully before the bamboo pieces slip out of line.

When the ambroid is well dried carefully split off the pieces of bamboo projecting beyond the frame on one side, small sliver at a time until they are all cut away flush with the outside surface of the frame. When all of these pieces are split off ambroid the outside surface of the spars where the bamboo comes flush with the surface and re-ambroid the inside junctions of the bracings with the spars again, especially the rear "X" braces which get a considerable strain.

Now insert the "cans" at their correct locations along the frame members and cement them with a generous coat of ambroid. Sight through the "cans" to see that they line up fairly closely.

Ambroid the bearings at the rear of the frame. Be sure that the bearings are mounted on the center line of the spars. Use three heavy coats of ambroid thoroughly dried between coats to make sure that the bearings do not come loose. This is important as the most numerous causes of grief among contestants at model contests are loose or torn-off bearings.

You will note in the drawing that the rear of the frame is reinforced by stretching a double strand of heavy silk thread across the frame. The silk thread should be tied up close to the motor base bearings and to prevent slipping it should be ambroided securely as considerable tension is put upon it. Dope it with a coat of paper cement to waterproof and strengthen it.

To complete the frame for your hydro model you have only to dope all of the balsa and bamboo pieces with two coats of paper cement.

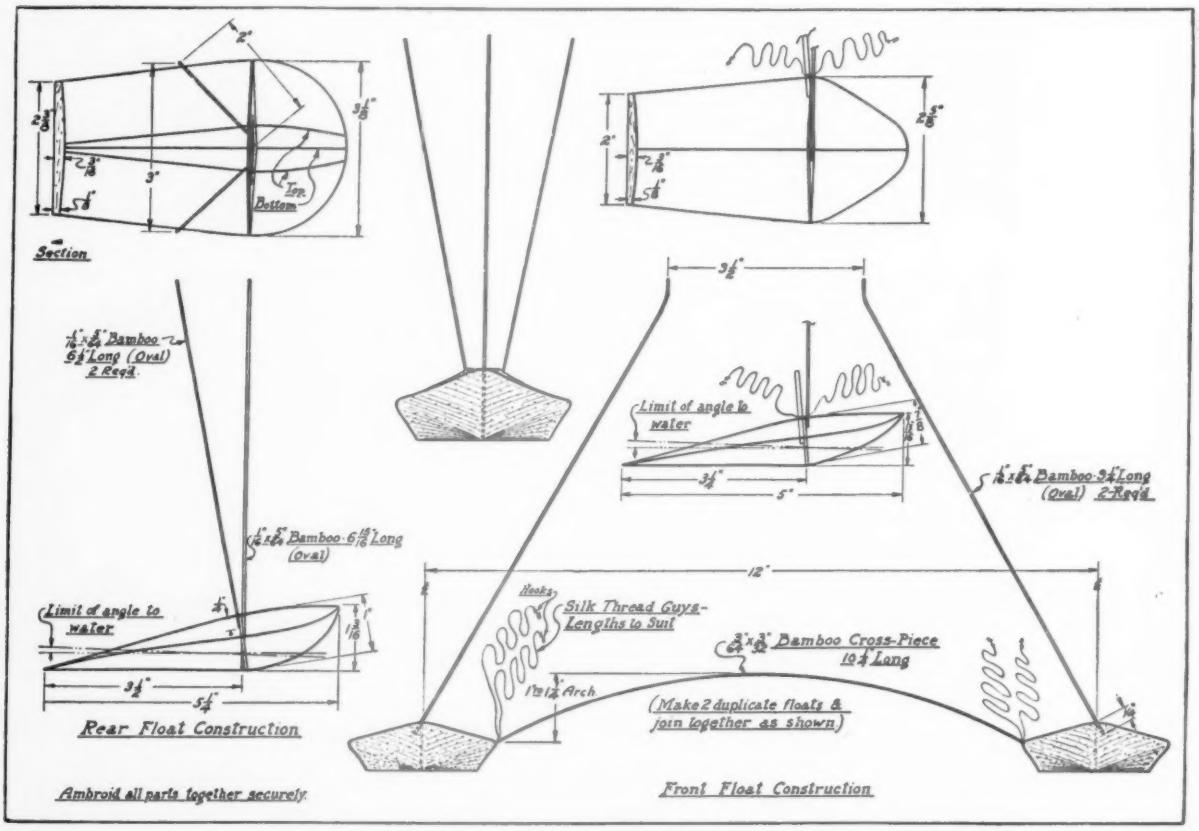
Frame weight .65 ounce.

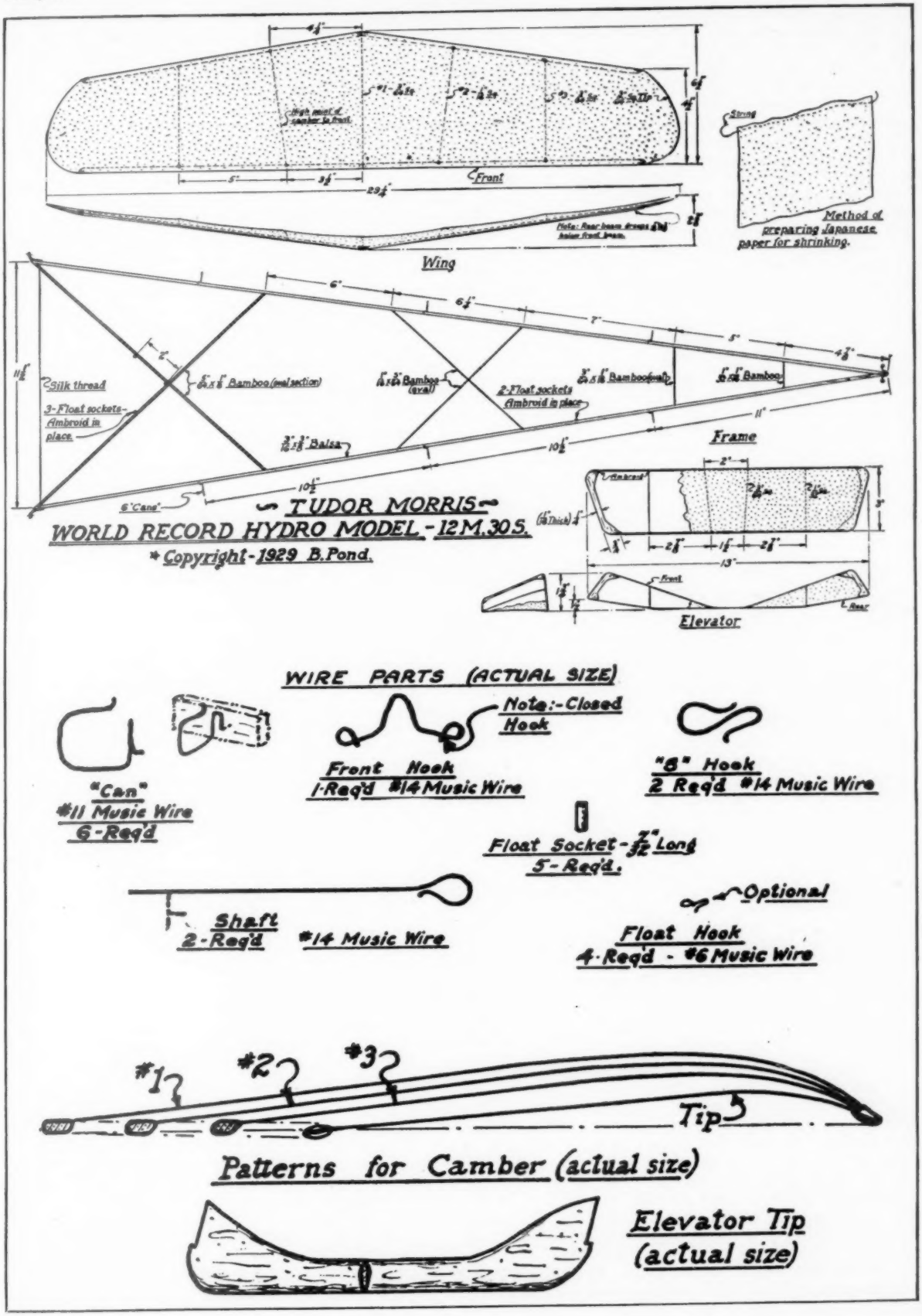
Propellers

The propellers are carved from blanks 5/8"x 1¼"x 12". They are made in the standard manner for making true pitch propellers. Mark the blanks with diagonal lines from corner to corner on the flat sides, using a very hard sharp pencil. Draw two lines 3/32" on each side of the center and parallel with the edges of the block to locate the hub. Because the point where the diagonal lines cross is not always exactly in the center, you should measure from each end in order to locate the other center line. Then looking at the ends of the two blanks when laid side by side, draw a diagonal line on the end of each blank so that one diagonal line will be opposite the other one. The idea of this procedure is to produce one left and one right handed propeller.

Then cut out the sides of the blanks to the diagonal lines on the flat face of the blank. Using the diagonal lines you have drawn on the sides and ends of the blanks as guide lines, carve the balsa wood away with a sharp pocket knife being careful not to carve into the guide lines. Do not round the tips of the propeller blades until last. The thickness of the propeller blades should taper gradually from the thickness of the hub at the center to about 1/16" out at the tips in carving.

First with coarse sandpaper, and then with fine sandpaper, smooth down the blades so that the front face is slightly rounded and the back is flat or slightly cupped. To finish the propeller it is only necessary to round the tips and cut out the back side of the hub slightly. Use a paper pattern to round the tips so that all four tips are alike. A semicircular shape on the tips is quite satisfactory and easy to make. With your





TUDOR MORRIS

WORLD RECORD HYDRO MODEL - 12M.30S.

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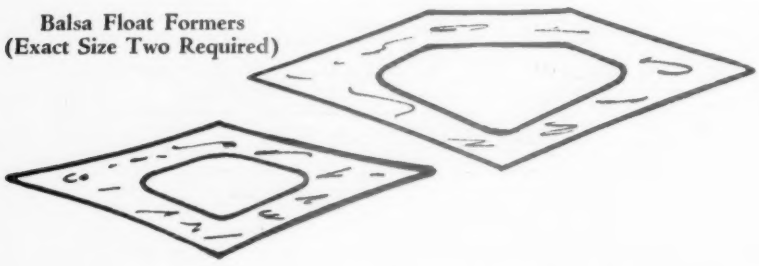
sandpaper thin down the edges where you have rounded off the corners of the propeller tips. The hubs should be cut down to about 3/8" in height from the back side. This cut-out should taper from the full thickness of the propeller blank at about 1½" from the hub to 3/8" at the hub. Balance the propellers very closely at this stage on the edge of your knife and lighten up the heavy ends by sanding until a very close balance is obtained.

Make the music wire propeller shafts as shown in the drawing and pierce them through the propeller hubs, first from the front and then from the rear and then bend over the end of the propeller shaft in place as shown in the actual size drawing of the propeller shafts. Pull the propeller shaft back in place so that the point of the U shaped end pierces the hub. Ambroid the propeller shaft in place securely after first sighting crosswise and lengthwise to see that it is lined up with the propeller. Give the propellers about 4 coats of banana oil with a light sanding between each coat to waterproof them. Now give your propeller a final close check for balance. Remember that they should not be too weak at the hubs and that the weight should be kept down by reducing the thickness of the blades out towards the tips and rear edges.

If you will refer to the article on carving propellers in Popular Aviation and Aeronautics, November edition, you will find that any questions or difficulties you may encounter in making your propellers will be clarified and made simple.

Propeller weight, .13 ounce for the pair.

Balsa Float Formers
(Exact Size Two Required)



Wing Construction

Slightly round the edges of the 1/8"x 1/4"x 14" balsa wing beams. Mr. Morris rounded the edges of the wing beams slightly more toward the ends than he did at the center.

The bamboo ribs you will notice are of the cambered type and should be bent to the size shown in the full sized drawing. Where two ribs are alike it is much easier to bend one wide piece and split it in two after being bent. This will assure you that both ribs will be alike and save you considerable time as well.

For the wing tips it is advisable to use the same method of bending the two in one piece and then splitting them apart. A "bamboo bender" will be found a great help for bending the bamboo. However, a hot poker or a very hot soldering iron may be used.

Don't fail to scrape the bamboo tips and ribs and other bamboo parts of the plane to the exact size specified. If the parts are larger they will be too heavy. If they are smaller they will probably be too flexible and not stand the load that they were designed for.

With the parts all made for the wing the assembly is a very simple matter. It is advisable to make an actual size drawing of the wing preferably on a piece of heavy corrugated cardboard and assemble the wing in halves. Lay the completed wing beams with their tapered ends extending toward the tips on the full sized cardboard drawing. Stick pins through the cardboard on each side of the wing beams to hold them in place. The ribs should have pointed ends and be about 3/16" longer than the space between the beams where the ribs should go. Placing the high part of the camber of the ribs to the front, insert the ribs at their proper places by sticking the sharpened points into the balsa wood. See that the ribs are set so that the camber is straight up and down, for a very crude wing results from having the ribs lying over on their sides. Ambroid the ribs to the wing beams. While the ambroid is drying work on assembling the other half of the wing. To get the proper curvature in the bamboo wing tip see the end view (with the patterns for camber). To get this curvature lay a pencil under the outer end of the bamboo wing tip while you are ambroiding it to the wing beams.

When both wing halves are securely ambroided together the pins can be removed from the pattern. They should be turned over and ambroided on the bottom side. Be careful not to use too much ambroid as this might tend to loosen the parts by softening the ambroid on the opposite side. While this bottom coat of ambroid is drying you should ambroid the center ends of all wing beams for about 1/4" back to prepare them for being joined.

Place the two halves of the wing on your work bench so that the two center ends of the wing beams are set up to each other squarely. The wing tips should be blocked up with books or other handy objects so that they are just 2" above the table. The extra 3/8 of an inch shown in the drawing the paper will take care of when it is stretched on the frame. Ambroid the point where the wing beams touch with three heavy coats of ambroid allowed to dry thoroughly between each coat. When the last coat is thoroughly dry turn the wing over and repeat the operation. Be sure to support the center of the wing 2" above your work bench as both coats of ambroid would cause the wing to lie out flat by softening the ambroid on top. When this last coat of ambroid on the bottom is well dried you should true up the wing if necessary so that the alignment will be perfect. To check this the front beam and the rear beam in each half should be parallel when sighted from directly in front of the center of the wing. Ambroid the center rib in place in the V formed by the junction of the beams, making sure that the high part of the camber is toward the front or straight edge of the wing.

Completed wing weighs .26 ounce (covered and doped).

Elevator

Using the actual size pattern shown in the drawing, make the two balsa elevator tips. The bamboo beams are stream lined and tapered from 3/64"x 1/16" at the tips to 1/16"x 5/64" at the center. Split the fine bamboo ribs to the exact size specified in the drawing. The elevator ribs may be very slightly cambered or flat. Too much camber in the elevator would spoil the extreme stability of the Morris model. A flat wing and a highly cambered elevator would have much less stability.

Make a full sized drawing of the elevator on a piece of corrugated cardboard the same as you did for the wing holding the parts in place with pins and weights while they are being ambroided.

When well dry the elevator framework should be turned over and reambroided on the bottom side. Avoid putting too much ambroid on the bottom as it might loosen the ambroid on the top and let the parts get out of line or come loose all together. Bend the elevator beams as shown in the drawing. Care must be taken in this operation to see that the front beam is bent close to the center and the rear beam is bent out at the outer rib. Bend the elevator beams over a bamboo bender so that you will not spoil the assembly. Dope the elevator framework with paper cement being careful that you do not loosen the ambroided joints.

See that both sides of the elevator are bent alike. This can be checked by laying the elevator flat on your work bench and measuring from the surface of your work bench up to the front and rear corners of the tip. Of course, the two rear corners should be of the same height, ½". The front corners should both be 1¾" high.

Elevator weight .09 ounce (covered and doped).

Papering

The wing and elevator are both covered with pre-shrunk and waterproofed Japanese silk tissue paper. On the main wing be careful that you stretch the paper slightly more lengthwise than you do crosswise. This is done to retain the cambered surface between ribs. If the papering is done smoothly it will not be necessary to dope it as it is already doped and shrunk considerably. You will find that the humidity changes in the atmosphere in a few days' or weeks' time will draw up the paper slightly and remove most of the small wrinkles.

Float Construction

The three floats are stream lined and have a knife edge all of the way around. They have a V bottom in front to spread the water easily and to enable the machine to clear the tops of small ripples and to get up on the planing edge quickly. Notice in the side views that the floats are almost of wing section shape. Combined with the angle at which they are set for a quick take off this shape gives the float some lift in flight. These floats are very easy to construct and if made according to the drawing and description your model will take off the water very quickly and easily. Notice that no step is used in these floats because the machine is balanced on the

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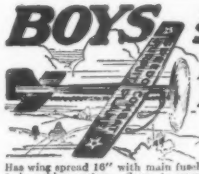

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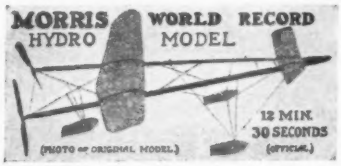

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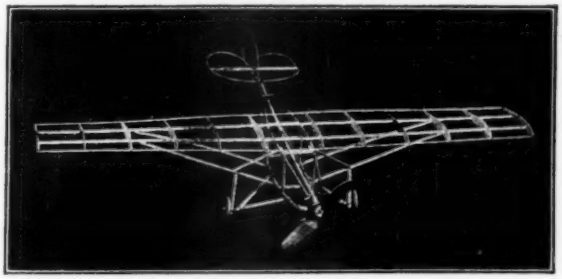

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Here's a new model plane especially designed for long flights—and speed! And best of all, it is one that you can build yourself. It's easy! All you have to do is lay it out on the plans and fasten it together with the nails, wire and cement which are supplied. Every part is numbered.

This is the way it looks when completed

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Packed in a handy kit with every part numbered

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Simplex Air Model Co.

AUBURN, MASS.

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1/16"x1/8"x3'	.03	
1/16"x 1"x3'		.06
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1/4"x1/4"x3'	.054	.06
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1"x 3"x3'		.48
1"x 3"x3 1/2'		.56

Reed 6' lengths, 1/16" diam. .05c; 1/8" .075c; 3/16" .10c; Balsa discs 1/8" thick 2" diam. .07c; 3" .08c; 4" .09c.

Ambroid dope, 1/4 pint .50; 1/2 pint..... .95
Ambroid cement, 2 oz. .33; 4 oz..... .53
Bamboo paper 13x36" .12; 24 1/2"x33 1/2"..... .14
Rice paper, 18"x24, .09; 21"x25"..... .06
Wood veneer, 20"x30"..... .22
Flat rubber 50' of 1/8", .50; 50' of 3/16"..... .75
Piano wire 3' of No. 5 or No. 8, .04; 3' of No. 11 or 15..... .06
28-30-32-34 steel wire, per spool..... .10
1/16" copper washers, 10 for..... .05

We can supply any size balsa that you need, also propellers, I beams, wing sections, bolts, nuts, screws, brads, aluminum, brass tubing, turnbuckles and books on model building.

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9 Ft. Model Plane Flies One Mile

And climbs 200 feet when equipped with this motor. It has many uses such as running an ordinary canoe, small row boat and light motorcycles. It is just what model plane builders have been looking for. It is an engine that will make their models fly.

Send at once for complete information and Bulletin No. 45 which describes this motor.

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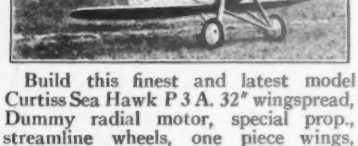
Model Aeroplanes



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Price knockdown form.....$12.00
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6 cylinder air motors alone.....$16.50

Send 10c coin for illustrated catalogue

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three planing edges just before taking off. A step is only necessary in the case where but one or two pontoons are used as in single flying boat hulls and twin float sea planes. The steps besides being entirely unnecessary in this case would be an added resistance as they would break the stream line of the floats.

Bend the bamboo edging for the floats and scrape them to 3/64" round section. Also bend the top and bottom float formers and scrape them to the same section as the edging. Notice that the rear float has two formers on top and one on the bottom. The front floats have one former on top and one on the bottom.

The trailing edges are formed of balsa wood sanded to a straight knife edge at the rear. The easiest method of assembly is to ambroid this balsa cross piece across the rear of the float outlines. Then set the formers (made to the actual size pattern) in place and ambroid securely. It is a simple matter then to ambroid the top and bottom bamboo formers in place.

For the rear float make three stream line bamboo struts and attach them to the former as shown in the drawing. To attach the rear float to the frame ambroid three pieces of socket tubing to the "X" bracing as shown for sockets to fit and hold the tapered upper ends of the rear float struts snugly.

The two front floats are held apart 12" from center line to center line with an arched bamboo crosspiece. This crosspiece is arched to prevent small waves from catching on it. Ambroid two stream line struts to the center of the front float formers as shown in the drawing. For attaching the front float set to the frame, ambroid two of the socket tubes to the frame at the location shown in the drawing to hold the pointed upper ends of the bamboo struts snugly. The front floats are braced to the frame by two silk threads in front which are hooked to the front bamboo frame cross member with small wire hooks. These hooks are made of No. 6 music wire to the size shown. The front floats are braced to the rear by two silk threads which cross each other and hook on to the center "cans" by means of two small wire hooks the same as used at the front. Carefully dope all of the float struts, formers, edges and threads with a coat of paper cement to waterproof and strengthen them. Paper the floats in the usual manner used in covering surfaces and dope with one coat of hydro dope. A good hydro dope can be made of one-fourth ambroid and three-fourths banana oil. Carefully examine the floats for holes and as a check water test them by submerging them under water. To remove any water which might leak into the float pierce a small pin hole in the paper at one corner of the float allowing all of the water to run to this point. Holding the float in this position place your mouth over the hole and suck out the water. Then close the hole you made with the pin as well as all of the holes which caused the leakage.

Complete float weighs: rear, .08 ounce; front pair, .11 ounce.

Assembling and Flying

We have described how to make all of the parts of the model with the exception of the "S" hooks and rubber motors. When these are made you will be ready to test fly your model.

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Jap Silk paper 21x24, extremely light, five sheets, 18c. Japanese tissue 21x31, five sheets, 25c. Pure Para Rubber 1/32x1/4, also 1/16x1/16. Skein 210 ft., $1.25; 1/32x3/16 skein 210 ft., $1.50. Forty pieces of bamboo 15x1/4x1/16 for 45c. One quart can of Ambroid Cement, $2.65 (sent express "collect"). C.O.D. orders and stamps not accepted. Look these prices over again! Yes—they're real.

Our finest performing 48" commercial model will soon be ready. Watch for it! Upon exhibiting it in our Cleveland Store for a short period we received orders for nearly a hundred kits for it. It's a whiz! Our new fully illustrated catalogue describing it and other models, large and small, with many new supplies and tools, now going to press. If you have not sent us your dime for one yet, do so now. Stamps not accepted. Those who have already enclosed dimes with their requests during the past few months will receive a copy without further correspondence.

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Start taking orders now! Remember, a $5.00 order will allow you wholesale prices to start with from

CLEVELAND MODEL & SUPPLY CO.
QUALITY — SERVICE
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String up two rubber motors of 19 strands each of ⅛"x 1/32" flat rubber or its equivalent. These should both be the same length and have only about two or three inches sag from the frame when hung in place outside the "cans." The motors are hung in the front yoke with "S" hooks made to the actual size shown in the drawing. Attach the main wing to the frame with two heavy rubber bands. Mr. Morris used two bands made out of ⅛" flat motor rubber, he said, because he had run out of suitable rubber bands. Use one strong rubber band for the elevator, as a loose elevator is a common cause of erratic flying models. It often happens that a model which ordinarily performs quite well will be a "flop" when crammed for contest flying as the extra strain put upon the elevator rubber band raises up the elevator slightly at the start of the flight causing the model to do a loop or wing-over and frequently smash upon its nose.

Thread the propellers around through their bearings so that they will turn up through the center and down on the outside. In other words the right hand propeller when viewed from the rear should turn clockwise.

Slip the float struts into their sockets and hook the front flat thread bracing hooks in their proper places. Find a place, preferably where there is soft tall grass, and glide the model by launching it level with your shoulders gently on an even keel at about its flying speed. Watch this glide carefully and correct the locations of the planes to obtain the proper balance. If the nose raises and the machine stalls before landing the wings should be moved slightly to the rear. If the machine glides off on an even keel for a long glide probably no adjustment will be needed. Be careful in gliding your model that you do not puncture the wings or floats. Gravel, cinders and stubble will do this very easily if you are not careful in selecting a place for gliding.

It is assumed that you have known about winding and understand how to stretch the rubber motors out and walk in as you wind. For a trial flight use about 125 turns of a five to one egg beater winder. This can be done easiest on land, but it is quite possible to wind a model in a boat. After winding, hook the rubber motors in place and slip them into the "cans." Quickly and carefully check the alignment of the floats, main plane and elevator, then set the model on the water facing any breeze that may be blowing and let go of it. The model should take off quickly and fly for a fair distance if you have found a close adjustment in gliding. If the model climbs steeply and stalls it will be necessary to move the wings back slightly for a second flight. However, if it flies on an even keel and very fast it is slightly

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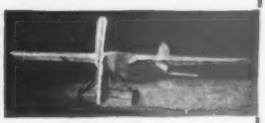

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under elevated and the wings will need to be moved forward. You have a perfect adjustment if the model stalls just slightly occasionally and climbs well between these slight stalls.

In making these trial flights you should recover your model as quickly as possible after it lands. As there is no pilot aboard the model occasionally lands crosswise to the wind and is turned upside down. If the model is left in the water in this position very long it is liable to soak up considerable weight of water in spite of the water-proofing. Also if you do not recover the model quickly it may be difficult to find again with only the three small floats sticking out of the water.

For a long successful flight after you have found the adjustment you should wind the rubber motors up 200 or 250 turns with a five to one winder. If you use 250 turns be careful to stretch the rubber well at the beginning of winding and wind slowly as you walk in to prevent the rubber from breaking. Hold the nose of the frame while you slip the rubber motors in the "cans" as the frame is under considerable strain and needs the protection of the "cans" to prevent it from breaking.

Set the model in the water in the usual manner facing the wind and let go of both propellers at the same time. Launch the model as soon as possible after winding as the rubbers soon become dead if they are held fully wound for any length of time. When the model takes off and starts climbing to a high altitude, a motor boat or outboard motor will be found very handy in chasing the model, especially if there is any breeze blowing. Mr. Morris' model travelled well over a mile in its record flight, so you can see that you would be quite liable to lose your Morris model unless you chased it as rapidly as possible. Mr. Morris states that his model flies as well with landing wheels or handlaunched without any chassis whatever as it does with the hydro equipment. Mr. Morris personally checked the drawings of his model in this article and the pictures are of his original model.

Morris' motors weighed .79 ounce each motor.

Table of Weights of Morris World Record Hydro Model

	Ounces
Propellers, each .065	.13
Wing	.26
Frame	.65
Elevator	.09
Front Float	.11
Rear Float	.09
Motors, each .79	1.58
Total Weight of Assembled Model	2.91

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3 ft. model

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Pilot Trouble vs. Engine Trouble

(Continued from page 25)

sooner. The dragging axle started the plane skidding sideways, known as a "ground loop"—but too much forward speed pushed it up on its nose where it balanced a moment. Five miles an hour too much speed helped the city editors fill their front pages.

The plane, much to my embarrassment, elected to fall over on its back. There was no noticeable jar in this unorthodox maneuver and my passenger and I crawled forth unscratched. This sort of thing could be performed a hundred times a day by a pilot who would get tired from it and nothing else. But here is how it reached the front page: "FLYER NEAR DEATH IN SPECTACULAR CRASH. MIRACULOUSLY ESCAPES WITH PASSENGER."

Everyone can remember reading of the perfect 3-point landings Lindbergh made wherever he went. The reporters were probably secretly hoping a wheel would come off, or something, that would let Lindbergh narrowly escape death, but instead he would make a good average landing, which pilots take as a matter of course. The perfect three point landing was made into something of extraordinary importance by reportorial zeal over Lindbergh's activities. Cannonball Baker racing across the continent couldn't provide news by making a perfect 4-wheel brake stop in front of the Hammond, Indiana, city hall.

Mentioning Hammond suggests a gentle rebuke to one of its reporters. "Swooped" was long a thrilling verb to describe an airplane's fall, but the Hammond reporter improved it greatly. He described a crash during the last 4th of July holidays like this: "—the plane swooned and crumbled to earth."

A bit of "pilot trouble" causing a plane to swoon is almost too much. But unless things improve we may read some day about a high strung sensitive airplane, worried over the price of gas, fainting over Main street. Perhaps the pilot will administer smelling salts to the senseless ship in vain, and down will come pilot, airplane and all.

Reporters are hard driven sometimes to get a story. It can scarcely be held against them if they sometimes make one, but the weird twists with which they handle airplane stories have done immeasurable harm to our air-mindedness.

However, there is a light gleaming afar, and certain newspapers are now putting their aeronautical news to the scrutiny of pilots or specialists on their staffs. These papers are enjoyed and patronized by aviators who would like to see more of their breed.

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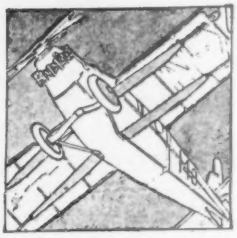

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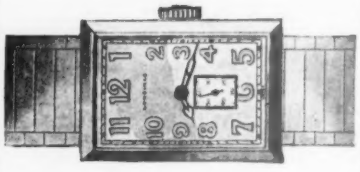

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Aviation Has a Place for College Men

(Continued from page 20)

tion in one of America's large commercial aircraft factories. The present shortage is forcing some new firms to import engineers from England and Germany.

Aviation has won for itself in the past adventurous, whole-hearted men and women who have responded to its romantic appeal. But its reputation of being a "game" rather than a career has no doubt turned many away. Aviation will probably never lose its adventurous aspect, any more than going to sea will, but it is no longer basically unsound.

If it achieves nothing else, the Alexander Awards will serve to awaken undergraduates to possibilities in the aero world, and stimulate those already hitching their wagons to a flying star. A student of Marquette University and a member of the Milwaukee Light Plane Club, states a universal collegiate truth, we believe, when he writes that he desires to enter aviation, "Not as a glory hunter, but in some sound capacity of benefit to the industry."

Modern Valkyries

(Continued from page 29)

of the machine. They were astonished when the monoplane gradually melted into a speck and then vanished. . . . .

"It was her first use of the compass, and she admitted afterward that she was doubtful of her ability to use it. Hamel had warned her of the danger of losing the course. Five miles out of the way meant the North Sea. Other aviators had lost their lives in attempting that flight, and Miss Quimby knew its peril.

The compass saved her. She was scarcely out of sight of the crowd before she was enveloped in a cloud bank. She ascended to a height of 6,000 feet to escape the mist. Those upper air lanes she described as cold of the kind that chills through and through. She was glad that she had worn extra apparel. The parting words of Hamel haunted her. The machine tilted out of angle, the gasoline flooded, the engine began to skip. She began to calculate on a landing. But to her relief the engine quickly resumed its normal beat. Then—'My eyes gratefully caught a strip of white sand and I knew I was within my goal.'

"Mayors in those days were not prepared to present golden keys and provide victorious parades at the drop of an aviator's helmet, but Miss Quimby was carried away on the shoulders of the people of Herdelot. Scientists took notice, and a page to the credit of a brave woman went down in history.

"The rest of her life was tragically brief. Only a few weeks after she had accomplished this Channel Flight an airplane accident snapped short her career; but she had been the first woman flyer to win world-wide fame."

Like most women aviators, Miss Quimby was distinctly feminine. She wore a costume of mauve satin. Not long before she was killed she predicted:

"The number of men flyers will always outnumber the women, just as chauffeurs outnumber the women who drive automobiles. I think women will go in for flying more as a sport than as a profession. There will be certain fields open to men that will not be open to women—for instance, in the military branches."

When the war broke out in Europe in 1914, among those who offered their services were Theresa Peltier, Helene Dutrieu and the Baroness DeLaRoche. Mlle. Dutrieu had been awarded the red ribbon of the Legion of Honor the year before, but France refused to permit the enlistment of women aviators.

The first woman killed in an airplane accident was Mme. Deniz Moore, in 1911. Susan Bernard March lost her life when she was taking a license test the following year.

Among the first Englishwomen to fly was Mrs. Maurice Hewlett, wife of the novelist. She gave up piloting after Miss Quimby's death. Another Englishwoman, Miss Trehawke Davis, was the first feminine pilot to loop a plane.

A severe test of feminine nerve in the air occurred when Miss Quimby was killed. Miss Scott, previously mentioned as one of the first American women to fly, was piloting another plane near Miss Quimby's when the latter spun into the ground. She made a perfect landing—and fainted at the controls when her plane had come to a stop.

Miss Moisant decided to give up aviation after her brother was killed. She announced her farewell flight at Wichita Falls, Texas.

"Some one suggested just before I went up that I had better quit while the quitting was good, but I wanted this flight as badly as the crowd wanted to see it.

"I mounted my machine, circled about

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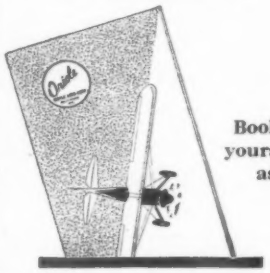

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for ten minutes, and attempted to descend. Then the crowd rushed forward and I had to kill some one or take a chance on myself. I chose the latter. My machine shot up about thirty feet, and came down with such force that the oil tanks were loosened. Instantly the machine was on fire. M. Houpert, my instructor, had anticipated trouble and quickly rushed to my rescue.

"When I was dragged from the burning machine my clothes were on fire and I had been burned about the face. Extra coats were thrown about me and the fire was put out. In five minutes the entire machine had been destroyed and the crowd was swarming around its skeleton. . . . . That was my last flight."

Most of the pioneer women aviators who were not killed gave up flying. Some of them, like Ruth Law, married and had children whose care kept them on the ground.

It is true also that a large percentage of the pioneers among the men who were not killed laid aside their helmets. Their careers as pilots were necessarily brief—a few years at most. When they were not killed, or incapacitated by accident, the strain and tension broke them down.

The first woman to distinguish herself in mountain flying was Adrienne Bolland, who hurdled the Andes in an airplane, and made other notable cross-country flights over South America.

Laura Bromwell was the first American woman to become a licensed pilot after the war. Two weeks before she was killed, in 1922, she made 133 successive loops with her plane, a record for women and a remarkable demonstration of the physical endurance of a woman pilot.

Negro aviators have been few. One of them was a woman, Bessie Coleman, who was a professional exhibition flyer and toured county fairs in the South, becoming a heroine of her race. She was killed, together with her publicity manager, a white man, when her plane crashed in April of 1926, at Jacksonville, Florida.

Of the eighteen American women who held licenses late in 1928 only two held transport certificates, enabling the pilot to carry passengers or freight over the commercial airways. The first woman to pass the rigorous test given by the Aeronautics Branch of the Department of Commerce to prospective commercial pilots was Phœbe Fairgrave Omlie, who had been flying since 1920, when she was eighteen. She and her husband, Captain V. C. Omlie, former Army instructor, operated a commercial line out of Memphis, Tenn.

Mrs. Omlie was the only woman to pilot a plane in the 1928 Ford Reliability Tour. She was the first member of her sex to undertake this 6,000 mile cross-country test. During the Mississippi flood of 1927, when much of the territory

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in which the Omlies were operating was under water, she transported nurses, medical supplies, food and mail for the relief of the victims. She was highly praised by the Red Cross, and was one of the aviators of whom President-elect Herbert Hoover, then Secretary of Commerce, said:

"Thousands owe their lives to these brave flyers."

Her career in the air began as a parachute jumper and wing walker in connection with exhibition flying. She was engaged in commercial work when, in the fall of 1928, she was seriously injured in a crash.

Ruth Nichols, of Rye, N. Y., who was given a transport license in 1928, learned to fly sea planes in 1922, when she was a student at Wellesley. Early in 1928 she acted as relief pilot in a nonstop flight from New York to Miami, Fla. After a career as a flying saleswoman for an airplane manufacturing company she became co-manager of an organization promoting a nation-wide chain of aviation country clubs.

Herta Junkers came from Germany to the United States to represent the interests of her father, Dr. Hugo Junkers, inventor of the all-metal monoplane, first used in the World War as a "flying tank." In 1926, flying from New York to Kitty Hawk, North Carolina, to lay an anniversary wreath on Kill Devil Hill in memory of Wilbur Wright, she was at the controls during much of the flight. The pilot was Fred Melchoir, formerly an officer of the Swedish Royal Air Force, who later dropped by parachute on Greenely Island to salvage the Bremen.

Lady Heath came from England, and Thea Rasche from Germany, in 1928 to make flying tours of the United States. Lady Heath was also a delegate to the International Civil Aeronautics Conference at Washington.

In the transoceanic flying of 1927-8 that followed Lindbergh's flight to Paris, a number of women, most of them pilots, became ambitious to be the first woman to fly across the Atlantic; one braved the Pacific. Three women, all of them passengers, crossed the Atlantic; one, with her pilot, was rescued at sea; another got as far as the Azores; four lost their lives.

Mildred Doran, an American school teacher, was a victim of the Dole Prize race over the Pacific from California to the Hawaiian Islands. She induced friends to finance her entry and engaged John A. Pedlar as pilot and Vilas R. Knope as navigator. They took off from the Oakland Airport in a Buhl-Wright plane, on August 16, 1927, and were lost at sea.

Princess Lowenstein-Wertheim, a veteran airplane enthusiast and the English widow of a German noble, was a passenger with Captain Leslie Hamilton and

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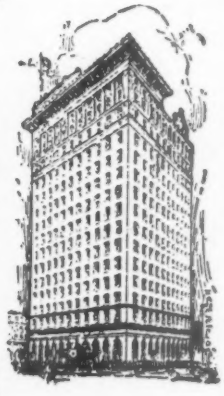

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Colonel Frederick F. Minchin in a Fokker-Bristol which started, on August 31 of the same year, from Upavon Airdrome, in England, for Ottawa, Canada. The flight was financed by the Princess. They were last reported 420 miles from New York, and perished in a storm.

Ruth Elder, a stenographer, of Lakeland, Fla., herself a pilot, persuaded wealthy men of Wheeling, W. Va., to finance her attempt to be the first woman to fly the Atlantic. Engaging Captain George Haldeman as pilot, she took off from Long Island in a Stinson-Wright, on October 11 of that feverish year. They had flown 2,620 miles, with Miss Elder at the controls for a few hours, when motor trouble forced them down about 350 miles from the Azores. They were picked up by a Dutch tramp steamer. The newspapers made a heroine of her, and she capitalized her fame on the stage and in motion pictures.

On the day following Miss Elder's rescue, Lillie Dillenz, a German actress, left Lisbon, Portugal, in a Junkers seaplane with Frederick Loose, Karl Loewe and Ralph Starke. They flew 1,050 miles to Horta, in the Azores, but proceeded no further.

Mrs. Frances Grayson, a Long Island real estate operator, was given support by a Danish woman, Mrs. Aage Ancker, of Copenhagen. In a Sikorsky-Wright amphibian, she had hoped to start across the Atlantic ahead of Miss Elder. With Wilmer Stultz as pilot, Brice Goldsborough as navigator, and Fred Koehler as mechanician, the plane made a false start from Old Orchard, on the Maine coast. Motor trouble forced them back. Mrs. Grayson quarreled with Stultz, who resigned, and she engaged in his place Oskar Omdal, who had been one of Roald Amundsen's pilots in the Arctic. Her plane was flying from Curtiss Field toward Harbor Grace, two days before Christmas of 1927, when a violent storm off Cape Cod dashed it into the Atlantic.

In 1928 the first woman to attempt the Atlantic crossing was the Honorable Elsie Mackay, the first Englishwoman to own and fly her own plane. For this flight she bought an American plane, a Stinson-Wright. Her pilot was the famous W. G. R. Hinchcliffe, who, despite the loss of an eye in the war, was rated as one of the best transport pilots in Europe. Flying mostly between London and Paris, he had had more than 9,000 hours in the air, which was believed to be a record at that time. They took off from Cranwell, England, and were last reported about 170 miles off the west coast of Ireland.

The first woman to fly across the Atlantic was Amelia Earhart, a Boston social worker who had learned to fly. Her flight was promoted by George Palmer Putnam, a publisher, and was made in a trimotored Fokker from Trepassey,

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Newfoundland, to Burry Port, Wales. The pilot was Wilmer Stultz. He never left the controls, in fair weather or foul, all the way across. The third member of the party was Lou Gordon, radio operator.

Stultz had passed through a remarkable series of experiences with women who wanted to be first to fly to Europe. After resigning as pilot for Mrs. Grayson he engaged to fly Miss Mabel Boll, "the diamond queen." Her plane was ready for flight when she read in the newspapers one morning that Stultz was on his way across the Atlantic as pilot for Miss Earhart.

On both sides of the Atlantic women have enthusiastically taken to air travel. Late in 1928 figures showed that more women than men traveled by airplane between London and Paris, the ratio being about four to three. In 1925 Mrs. Goldstrom accompanied me on an extensive tour of the European airways; she had previously flown with me in the United States; and found the limitation of light baggage no serious handicap.

The European airdromes have dressing rooms and maid service. Women in evening gowns board aerial limousines leaving London in midafternoon and arriving in Paris in time for dinner and the opera. They may fly back over the Channel the same night, making what formerly was an overnight journey, by train and boat, in two and a half hours.

In the first quarter-century of aviation feminine air travelers have journeyed over continents and oceans. They have not yet essayed flights around the world, to the Poles, into the upper atmosphere, or in planes of high speed.

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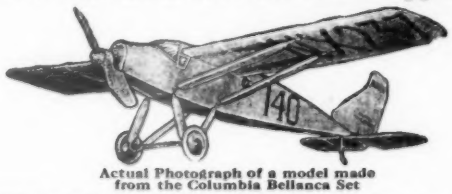

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Current Comment

(Continued from page 48)

nor a land or sea officer, whose ideas are wholly colored by his education and the needs of his own particular branch of defense, is qualified to judge the air freely and impartially.

Congress should create a new and separate line of defense with its own chiefs and officers—men schooled to the air, to whom it is their whole existence. It is in this specialization that power lies.

A great new military college, devoted wholly to the aeronautical service, should be built to which young men will go by rigid appointment, as they do to West Point and Annapolis.

This should be built somewhere on the open plains of the Middle West, perhaps at Wichita, Kansas, or in the north of Texas.

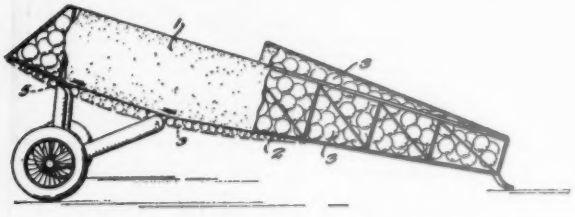
The President of the United States is the only proper commander to whom the judgment of the aeronautical admirals should bow. Anything else is mad and dangerous.

The people of America should force Congress to act upon this matter before it gets so balled up with the military, naval and swivel-chair forces that nothing short of disaster could change it.

Perhaps also when this happens the few favored members of the aeronautical trust who are attempting to hogtie the industry for their own personal benefit will sell their paraphernalia under a little stricter competition. Perhaps the perfectly marvelous prices some of them have been receiving will even be shaved a little. *Who can tell?*

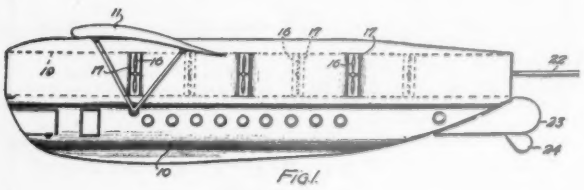
Patent Department

No. 1,704,612, AIRCRAFT FLOTATION DEVICE, Patented March 5, 1929, by Frederick Hosmer Johnson, of Kenmore, New York.



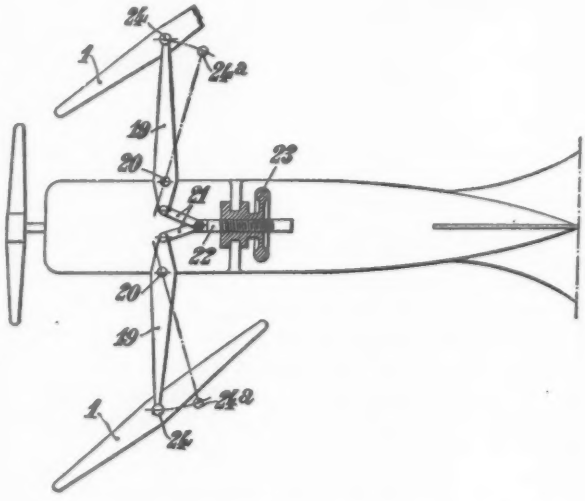
The object of this invention is to provide a multiplicity of gas or air-containing balloons or bubbles in suitable places in the interior of the wings and fuselage of an aircraft so that the aircraft will be water-buoyant. The patentee suggests that the bubbles be filled with a flame extinguishing gas, in the event of the aircraft taking fire.

No. 1,703,916, TUNNEL AIRBOAT, Patented March 5, 1929, by Karl Max Erich Zwinkel, of Denville, New Jersey.



The invention relates to an airplane preferably adapted for emergency use as a boat upon the water as well as for flying in the air. The patentee provides one or more tubes extending longitudinally of the machine with which tubes a plurality of motor driven propellers communicate. In the preferred form a single centrally arranged tube is employed and two rows of propellers communicate with the tube. These propellers are so arranged that the compression within the tube increases gradually from front to rear. To accomplish this the speed of rotation of the propellers progressively increases from front to rear, and also the pitch of the propellers increases progressively from front to rear.

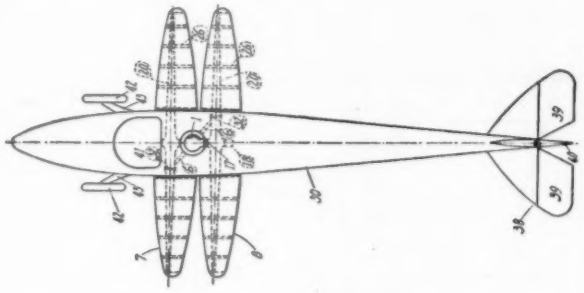
No. 1,704,034, AIRCRAFT PROVIDED WITH ROTATING WING SURFACES, Patented March 5, 1929, by Lucien Chauviere, of Paris, France.



In this invention the following are provided: a shaft for rotating the wing surface, a pinion rigidly secured to the shaft, a driving shaft, a second pinion coacting with the first

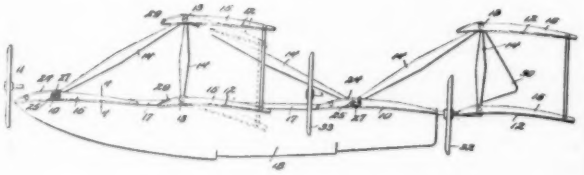
mentioned pinion, a universal joint connecting the second pinion to the driving shaft, the center of the universal joint being in axial alignment with the center of rotation of the wing surface, a casing surrounding the joint, a bearing for the second pinion in said casing and a blade connected to the casing, the blade being arranged to resist wind pressure transversely to the first mentioned shaft and balance the torque produced in the casing during rotation of the wing surface.

No. 1,704,112, AIRCRAFT, Patented March 5, 1929, by William Stelzer, of Chicago, Illinois.



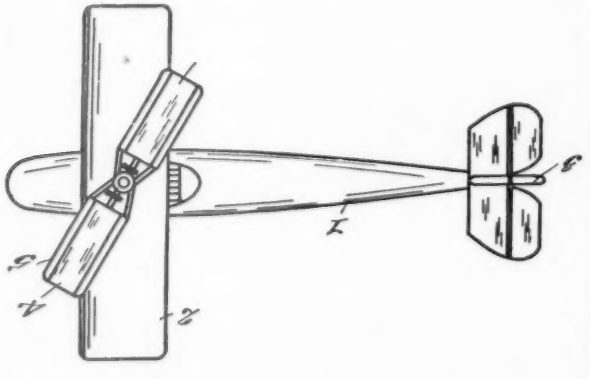
The aim of this invention is to combine the object of the patentee's invention filed November 17, 1927, serial No. 240,798, with oscillating wings, whereby the airfoils which are rotatable about single spars are intersected into a number of individually spring controlled panels and will warp easily.

No. 1,704,449, FLYING MACHINE, Patented March 5, 1929, by Julius Von Waldy, of New York, N. Y.



In this assembly front and rear sets of wings are arranged in tandem, each set comprising a fixed wing and a plurality of superposed wings in rear thereof, each of the superposed wings comprising a fixed front portion and a movable rear portion, the last named wings being arranged in pairs with the wings of each pair mounted on opposite sides of the machine.

No. 1,704,719, AEROPLANE, Patented March 12, 1929, by Gustavus Bess, of Seattle, Washington.



This helicopter aeroplane comprises a tiltable driving shaft, a pair of spaced propellers rotatable therewith, means for

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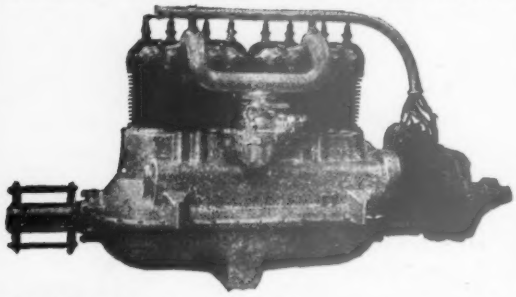

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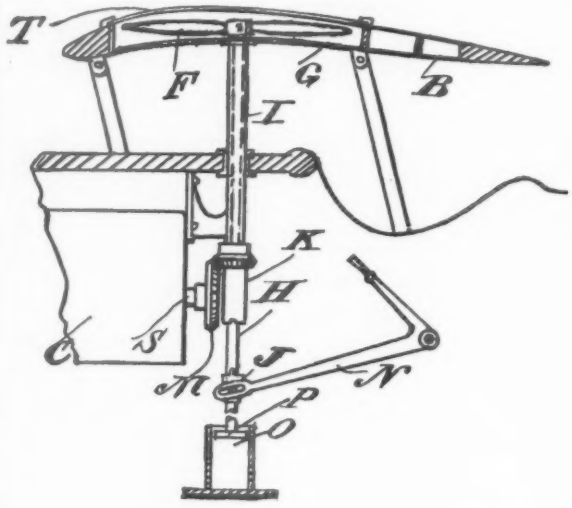
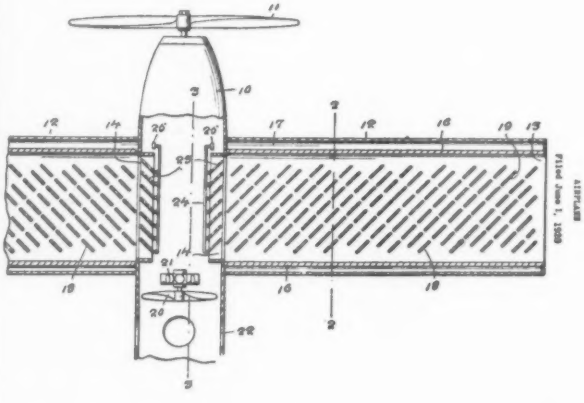
driving the shaft, means for tilting the shaft, a slide spool on the shaft and bearing means therefore, a rack bar connected to the spool, and a rack wheel on the tiltable propeller for coaction with the rack bar.

No. 1,704,753, HELICOPTER AEROPLANE, Patented March 12, 1929, by Frank B. Many, of Cleveland, Ohio.



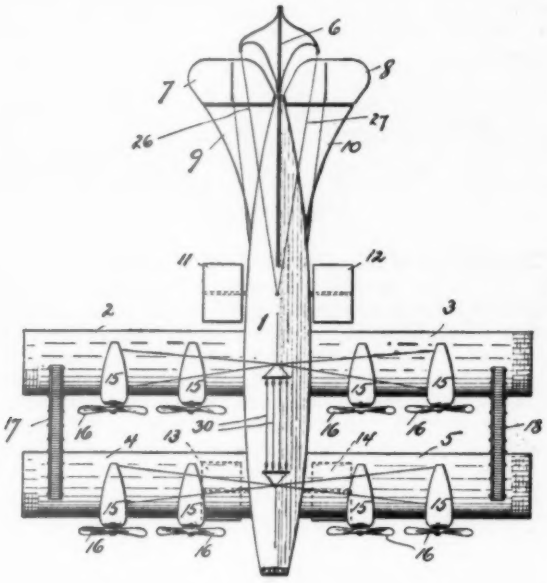
The subjects of the invention are to provide an aeroplane with disappearing helicopter blades in which the axis of rotation is vertical, and by means of which the airship may be lifted vertically from the ground, if the airship is of the ordinary type, or from the water, when the ship is of the hydroplane type, thus permitting it to rise from a restricted space such as the deck of a vessel or from the top of a high building, or when enclosed by trees, without danger of striking against any surrounding objects, which might occur if its path were inclined in the ordinary manner.

No. 1,705,387, AIRPLANE, Patented March 12, 1929, by George Albert, of Prescott, Arizona.



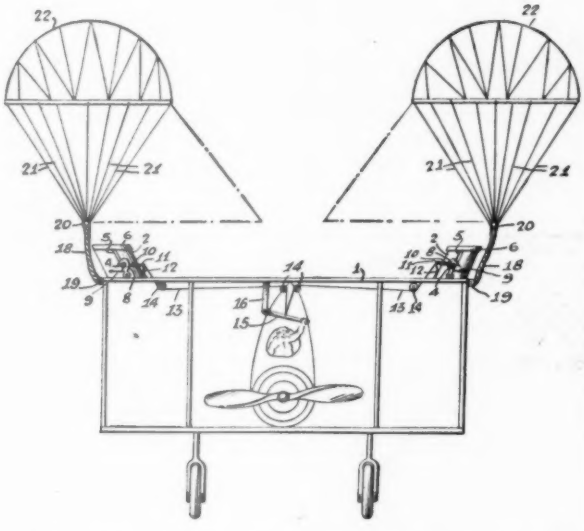
This invention relates to airplane wing structure and means to create a current of air therethrough. The wings are hollow, open at their outer ends and communicating with the interior of the airplane body at their inner ends. A suction fan is located within the fuselage immediately behind the line of the rear edge of the wings, and is intended to draw a current of air inward through the wings. These means are in conjunction with the usual traction propeller.

No. 1,704,831, FLYING MACHINE, Patented March 12, 1929, by Alfred Herbert, of Montclair, New Jersey.



This flying machine comprises two pairs of spaced stationary wings of substantial depth, the pairs being provided on either side of the body portion in tandem relation and in substantially the same horizontal plane and each wing including cabins for housing a propeller-driving engine, movable steering planes disposed below the wings, a single means for simultaneously adjusting the steering planes.

No. 1,704,891, PARACHUTE FOR AEROPLANES, Patented March 12, 1929, by William J. Hall and Cyrus Field Willard, of San Diego, California.



The patentee provides two or more parachutes, releasable from compartments on the upper surface of the wings of an aeroplane, for the purpose of supporting the aeroplane in an emergency.

No. 1,704,895, POWER SYSTEM FOR AIRPLANES, ETC., Patented March 12, 1929, by William E. Higby, of Monument, Colorado.

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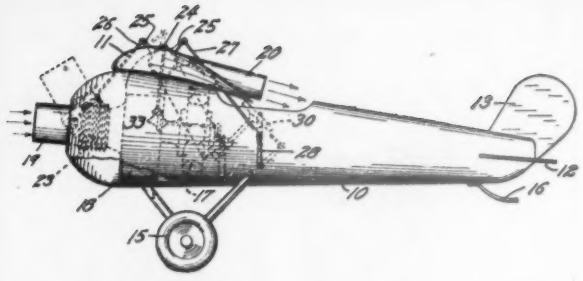
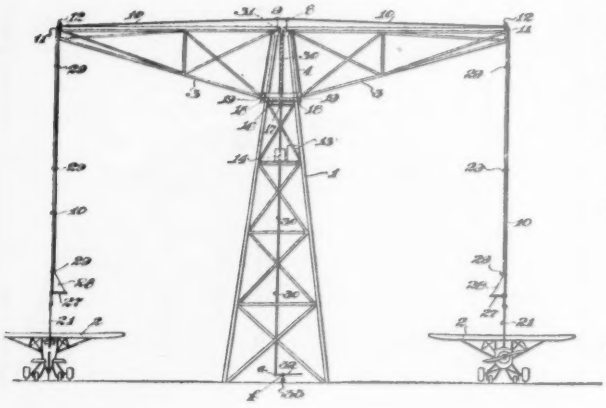


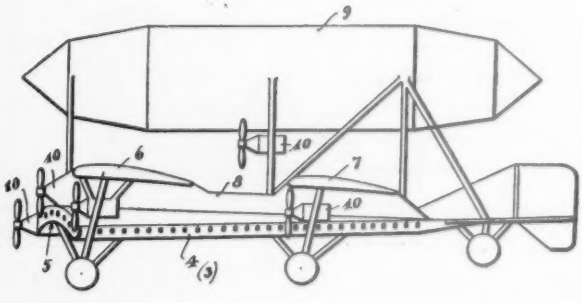
In this invention, the patentee provides a fan and other means for supplying air blasts for the propulsion of an airplane or the like and for guiding the airplane both vertically and laterally.

No. 1,704,968, AIRPLANE TAKE-OFF, Patented March 12, 1929, by William E. Gale, of Dallas, Texas.



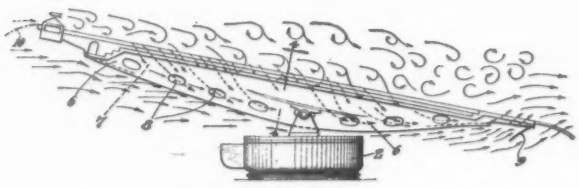
This invention relates to an automatic take-off apparatus and includes a tower; a revolving member mounted atop the tower and having means for joining cables thereto; means carried by the opposite ends of the cables to effect their connection with the body of an air-plane, whereby the latter will be constrained in ascending to encircle the tower to gain cruising speed, means to allow the plane to assume natural flying angles when so constrained, and ground means for effecting release of the plane from the cables when such speed has been attained.

No. 1,705,170, COMBINATION AIRSHIP AND AEROPLANE, Patented March 12, 1929, by Peter Arndt, of Los Angeles, California.



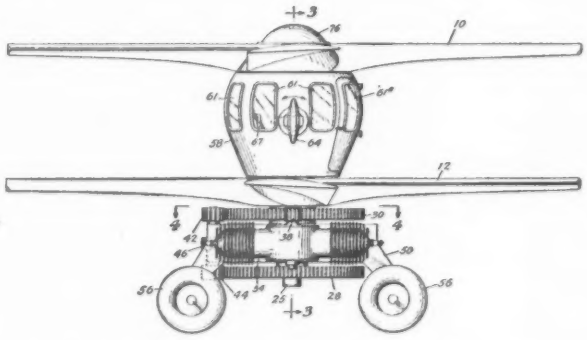
The objects of this invention are to provide longitudinally disposed planes designed to embody cabins, above which are transversely disposed planes and a gas-holding structure above the last mentioned planes.

No. 1,705,432, AIRPLANE LANDING APPARATUS, Patented March 12, 1929, by Pliny Kilburn Westcott, of Brooklyn, New York, Assignor to Mary A. Kenney, of Brooklyn, New York.



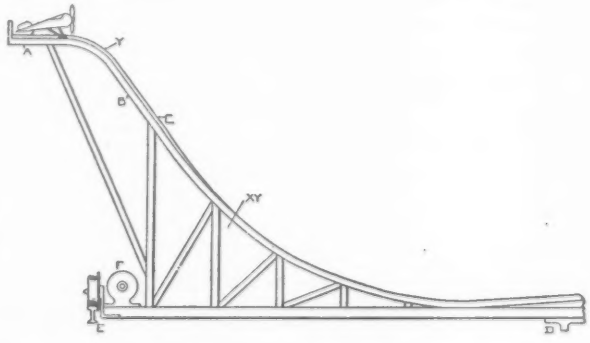
The platform of this apparatus is of honeycombed or grid-like construction in order to permit air to pass substantially uniformly through different areas of the platform. The inventor claims that in accordance with the invention the natural air currents or wind to which the apparatus will be subjected in use, are so controlled in moving past the apparatus as to produce a rarefication of the air immediately above the runway, thereby decreasing the lift on the machine as it nears the runway and enabling it to drop on the runway in a comparatively short period of time.

No. 1,705,489, HELICOPTER TYPE FLYING MACHINE, Patented March 19, 1929, by Frank Mladinich, of New York, N. Y.



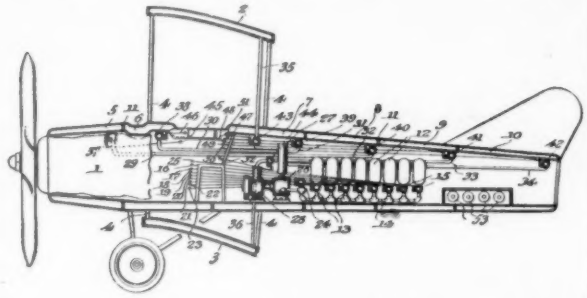
In this helicopter, the patentee provides upper and lower wing supports rotatably supported on a fixed vertical column, with power transmitting means interiorly of the column for moving the upper wings and exteriorly of the column for moving the lower wing supports. A parachute pocket is provided with a displacable wall.

No. 1,706,065, AIRPLANE LAUNCHING GEAR, Patented March 19, 1929, by Charles Francis Jenkins, of Washington, District of Columbia.



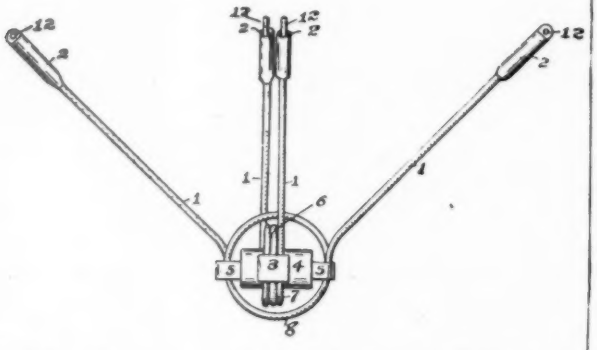
This inclined runway, for taking off in fields where space is restricted, is equipped with a tail-skid support-guide, of varying elevation in respect to the level of the wheel-runway.

No. 1,705,535, AEROPLANE, Patented March 19, 1929, by Frank L. Riffert, of Haubstadt, Indiana.



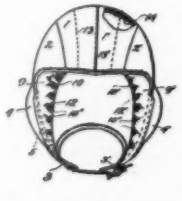
This invention contemplates hollow wings or planes, compartments for the body, gas containers, a pump, pipe connections, valves, and controls, enabling the pilot, or his mechanician, to permit lighter than air gas stored in the containers to be introduced in the wings or the body compartments, or both, selectivity, or as an entirety, to increase the lifting effect when the aeroplane is "taking off," or to increase the poise and buoyancy of the aeroplane when it is in midair as, for instance, should the engine stall and it become necessary to descend, or, to assist in supporting the plane to enable minor repairs to be made.

No. 1,705,854, SPRING OPENER FOR PILOT PARACHUTES, Patented March 19, 1929, by John J. Coughlin, of Dayton, Ohio, Assignor to Follmer-Clogg & Co., of New York, N. Y., a corporation of New York.



This spring opener comprises a plurality of coil springs set one within the other and at angles with each other, in combination with upwardly projecting arms connected to and moved by the springs, and a centrally located retainer for the springs, having a tying element located within the coil springs, and looping elements secured to the tying element, each enclosing a side of the coil springs.

No. 1,705,879, AVIATOR'S HELMET, Patented March 19, 1929, by Alfred A. Rodgers, of Los Angeles, California, Assignor to Scully Bros., Inc., of Los Angeles, California, a corporation of California.



The invention consists of a headgear or helmet of suitable substantial material formed to fit over and cover the top of the head and envelop the forehead, the back of the head and

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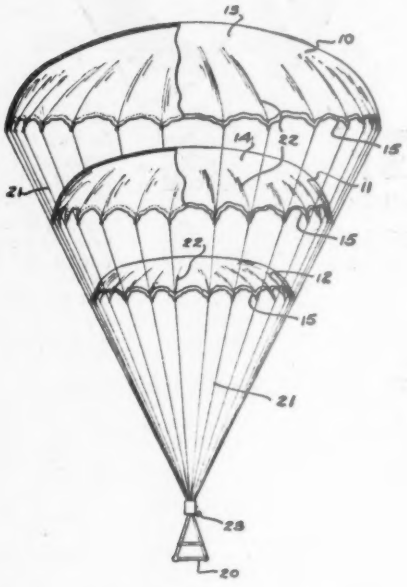
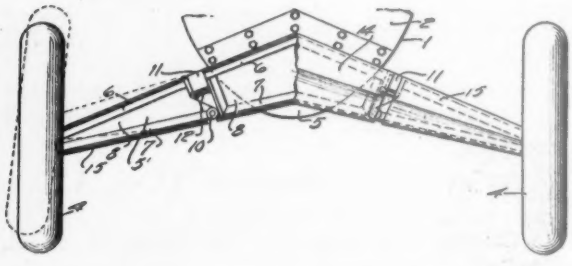
the sides of the head, and formed with lateral enlargements or pockets for the accommodation of the ears. It also consists of a helmet having elastic means which, when the helmet is adjusted to the head of the wearer, automatically adapts itself snugly to the face and thereby prevents inrush of air in the region of the aviator's ears; and it also consists of a helmet provided with means for preventing fluttering of the material in the top of the helmet.

No. 1,705,909, PARACHUTE, Patented March 19, 1929, by Jennings De Witt, of New York, N. Y.



The inventor provides, for the edging of his parachute, a material less flexible than the material of the balance of the parachute and crinkles or crimps this edging, so as to provide conducting passageways for air. He suggests binding tape for this edging.

No. 1,705,896, LANDING GEAR FOR AEROPLANES, Patented March 19, 1929, by Harry T. Booth, of Freeport, New York, Assignor to Leonard W. Bonney, of Flushing, New York, and Kirkham Products Company, of Garden City, New York, a corporation.

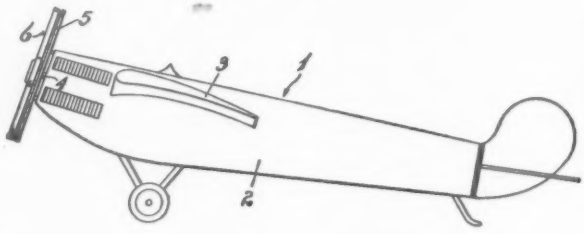


This landing gear comprises an inverted V-shaped axle fastened at its apex to the craft framework and divided transversely into three parts with a rigid central part having the two end parts pivotally carried thereby for vertical movements about horizontal axes, the pivoted parts being spaced from the central part at their upper edges, and having disposed therebetween compressible and resilient devices to yieldingly resist the upward movements of the axle ends, means for limiting the relative downward movement of the pivoted axles.

No. 1,706,294, AIRCRAFT COVERING, Patented March 19, 1929, by Isadore M. Jacobsohn, of Chicago, Illinois, and Starr Truscott, of Birmingham, Ohio.

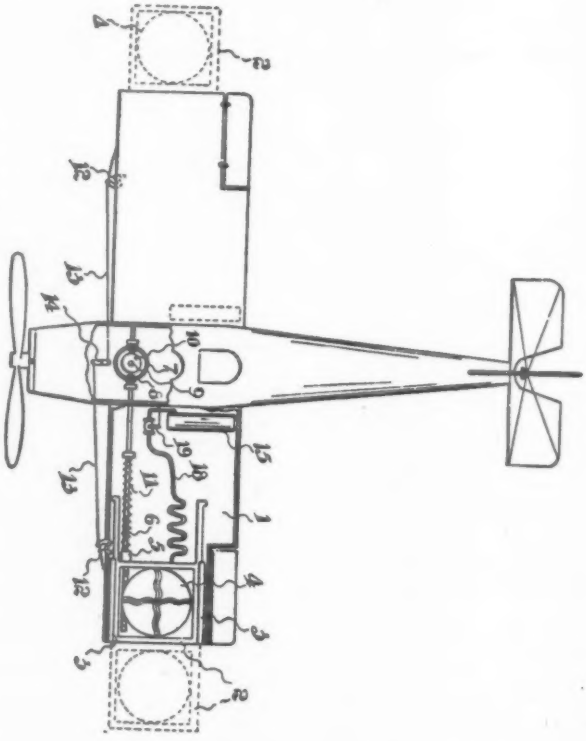
It is claimed that, in coating a fabric with sizing and applying thereto a layer of a mixture of regenerated cellulose and rubber redispersed in organic solvents, the fabric will be rendered impermeable to gases, and yet flexible, and that this method will eliminate the use of goldbeaters' skins.

No. 1,706,457, AIRPLANE DRIVE, Patented March 26, 1929, by Noah Moser, of Long Beach, California.



A reduction of air pressure in aeroplane drive is claimed by the combination of a circular plate secured to the fuselage forwardly of the engine, and an impeller rotatable by the engine and positioned immediately in front of the plate, and a conical deflector extending forwardly from the impeller and covering only the central part of the impeller.

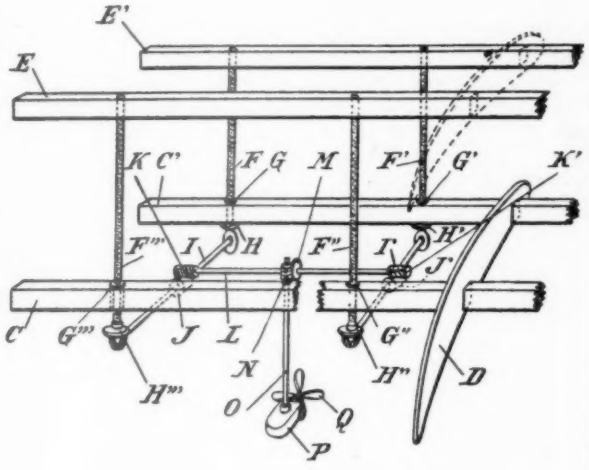
No. 1,706,677, SAFETY ATTACHMENT FOR AEROPLANES, Patented March 26, 1929, by Domenico Pallaria, of London, Ontario, Canada.



This attachment is provided for aeroplanes particularly intended for long distance flights over water and which aeroplanes are not provided with permanent floats or the like. The inventor provides a frame which may be extended in case of need outside the structure, and which carries an inflatable air bag, and by providing means whereby the air bag

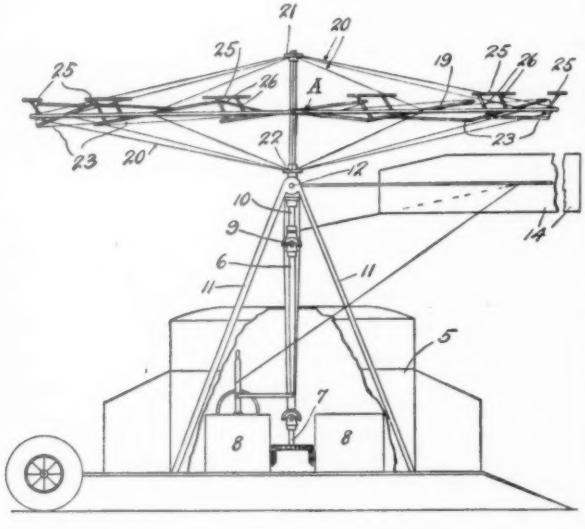
when so projected may be inflated. Preferably such a safety device is located in each wing tip of a monoplane or in the lower wing tips of a bi-plane.

No. 1,706,956, AUXILIARY AND MOVABLE WINGS TO BE BROUGHT IN USE ON THE DEPARTURE AND ON THE LANDING OF HIGH SPEED AEROPLANES, Patented March 26, 1929, by Fernan Oscar Conill, of Marseille, France.



The auxiliary wings make a bi-plane of the monoplane, doubling the sustention area, upon departure and landing, but these wings may be moved in juxtaposition to the regular wings, during flight.

No. 1,707,177, AEROPLANE, Patented March 26, 1929, by George W. Ray, of Forty Fort, Pennsylvania, Assignor to Marika Youssoupovna, of Kingston, Pennsylvania.



This is an improvement on the patentee's patent No. 1,671,164, issued May 29, 1928, and comprises a lifting and propelling mechanism comprising a hub portion, with a plurality of blades radiating therefrom, the blades being mounted on shafts radiating from the hub so as to be rockable on the shaft, and having adjacent edges capable of overlapping and the provision of governor ailerons on the blades to maintain them in a closed position when an aeroplane is falling and to hold them at the proper angle of incidence when the device is rotating for lifting and propulsion purposes.

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Index to Advertisers

Ace Aeroplane & Model Supply Co..... 98
Advance Aircraft Co..... 8
Aero Model Company.....115
Aeronautica 105
Air Activities, Inc..... 49
Airtech Training School... 105
Alexander Aircraft Company 82-116
American Eagle Aircraft Corp. 33
American Model Aircraft Company 95
American School of Aviation 56
Aviation Engineering School 75, 105
Aviation Financing & Trading 85
Aviation Institute of U. S. A. 111-113
Barrett Airways, Inc..... 101
Beck Distributing Corp.... 101
Becker's 101
Berry Bros. 37
Braley School of Flying, Inc. 68
Cessna Aircraft Co..... 83
Cleveland Model & Supply Company 96
Command-Aire, Inc..... 43
Daiber, Emil.....109
Doyle Aero Corp.....101
Du Page Flying Academy.. 49
Dynamic Mfg. Co..... 96
Eagle Airport School of Aviation 105
Fairchild Aviation Corp.... 3
Fleischmann Trans. Co..... 99
Gordon & Ferguson, Inc....104
Greer College 74
Guardian Air College..... 65
Hawthorne Model Aero Co.. 98
Heath Airplane Co..... 86
Henley, Norman P., Pub. Co. 72-79-87
Hotels:
Benjamin Franklin 87
Carlton 103
Clift 102
Drake 99
Robert E. Lee.....103
McCormick 108
Manger 90
New Bismarck 90
Ideal Aeroplane & Supply Company 97
International Engineering Corp. 86
Johnson Company..... 84
Kinnear Mfg. Co..... 81
Lancaster & Allwine....102-105
Laprade, L.....105
Lincoln Aircraft Co..... 4
Lincoln Airplane School.... 77
Los Angeles Chamber of Commerce 5
Logan Toy Works..... 98
McGraw-Hill Book Co.....114
McMullen Aviation School..105
Mann & Benton..... 98
Marshall Flying School, Inc. 53
Melvin Mfg. Co..... 98
Meyer, N. S..... 86
Midland Model Works..... 99
Midwest Airways Corp.....105
Miniature Aircraft Corp.... 96
Model Airplane Supply.... 98
Mohawk Aircraft Corp..... 41
National Aero Corp.....108
National Aviation Training.104
Naturaline Co., of America. 2
Nicholas Beazley..... 39
Northern Aero Corp.....105
O'Brien, Clarence A.....104
Pacific Tech. Univ.....102
Parks Air College.....71, 89
Peru Model Airplane Shop. 95
Pitcairn Aviation, Inc..... 51
Polachek, Z. H.....101
Porterfield Flying School... 55
Robinson, H. S., & Co..... 84
Ronald Press Co..... 80
Roth-Downs Airways, Inc... 62
Ryan, T. C., Flying School..103
San Antonio Aviation & Motor School 105
Selley Mfg. Co.....105
Simplex Air Model..... 96
Smith, Edw. B., & Co..... 83
Speedo Mfg. Co..... 95
Star Aircraft Co.....107
Swallow Airplane Co..... 47
T. A. T. Flying School..... 61
Texas Pacific Coal & Oil Co. 10
Travel Air Co..... 35
U. S. Model Aircraft Corp.. 98
Universal Aviation Schools 66-67
Von Hoffman Aircraft School 59
W. & J. Airplane Shop..... 95
Whittelsey Mfg. Co.....44-45
Wittnauer, A., Co.....100
Wright Aeronautical Corp... 6
Yellow Cab Airways, Inc...104
Yoho & Hooker Lumber Co..107

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